

DEPARTMENT OF THE INTERIOR

---

ANNUAL REPORT

OF THE

TOPOGRAPHICAL SURVEYS  
BRANCH

1918-19

*PRINTED BY ORDER OF PARLIAMENT*



OTTAWA  
THOMAS MULVEY  
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY  
1920







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# REPORT

OF THE

## TOPOGRAPHICAL SURVEYS BRANCH

### PART I—FIELD WORK.

Although the surveys appropriation for 1917-18 had been reduced by \$200,000 from that of the previous year, a further reduction of \$280,000 was made in 1918-19, the total amount of the appropriation being only \$496,300.

Only thirty-six parties were employed whereas the numbers for the three previous years were forty-one, fifty, and sixty-five, respectively. Ten of the thirty-six parties were employed partly in one province and partly in another, five were employed exclusively in Manitoba, eight in Saskatchewan, ten in Alberta, and three in the railway belt of British Columbia. No men were engaged for work on survey parties who were eligible for military service, or who were suited for agricultural work or for other pressing national service, and the number for each party was reduced to the lowest possible number consistent with reasonable efficiency.

To assist in placing returned men on the land two parties were sent to the Peace River district to classify the lands in that vicinity that had been reserved for soldier settlement.

A most desirable tract of prairie land along Keg river in the Peace River district was as yet unsurveyed. Although this land was somewhat difficult of access, it was considered advisable to have it subdivided immediately so that there might be no hindrance to settlement when the district opens up. At the time of survey there were already several squatters on the land.

Six parties were employed in retracing the boundaries of school lands. The object of these retracement surveys was to permanently mark the corners and to accurately determine the areas in these townships of all quarter-sections of school lands which had not yet been patented.

#### RETRACEMENT OF BASE LINES.

The survey of base lines had been advanced so well in recent years that it was possible to suspend temporarily the survey of additional lines. Two parties were detailed to retrace block outlines run a number of years ago. One party worked in northern Saskatchewan, and the other in southern Manitoba, Saskatchewan, and Alberta.

*Party No. 1.—Retracement of block outlines in southern Manitoba, Saskatchewan, and Alberta.*

The purpose of these retracements was to ascertain the correct bearings and chainages of the lines joining the monuments, as they are on the ground, the direction of the lines being determined by frequent and accurate observations for azimuth. These lines were originally run many years ago when the accuracy required was below that demanded for the control of the present surveys.

#### PERSONNEL:

J. R. Akins, D.L.S., in charge.

#### Assistant—

G. H. Herriot, D.L.S.

#### Levellers—

G. W. Bannister,  
E. L. Ashwell.

#### Party—

7 employees.

Horses for transport were purchased in southern Alberta as near the commencement of the work as possible in order to save the cost of transportation, and also because the prices asked were not so high as in northern Alberta.



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The first work was the retracement of the 2nd base line from range 15 west of the Fourth meridian to the Fifth meridian. During this survey the wind was so high as to interfere with chaining and instrument work, at which times work had to be suspended until the wind fell.

St. Mary's river, reached on June 27, was too deep to ford and the nearest bridge was twelve miles away. No boats were available so one had to be made. A bridge over Belly river, however, reached on July 3, made crossing easy.

The 2nd base line was tied to the international boundary by a line surveyed south between ranges 27 and 28. This line was wooded and very rough giving the levellers much trouble.

From the 2nd base line the Fifth meridian was retraced north to the 3rd base, but as the meridian north of this point crosses the Porcupine hills which are heavily wooded, and there was only one axeman on the party, an offset was made along the 3rd base around the hills and back to the meridian on the 4th base. The survey of the meridian was stopped at the 4th correction line.

The surface along the meridian is very rough and although there were two levellers they found it difficult to keep up with the remainder of the party.

The next work was retracing the 4th base easterly from the Principal meridian through seven ranges. Although this district is fairly well settled considerable cutting was necessary on the line where bush was encountered. The retracement of the 2nd base line was then made easterly from the Principal meridian through nine ranges and the survey of the east boundary of range 7 was made northerly from the 2nd base to the correction line. Here the cutting was so heavy it was decided to follow along the railway across range 7 in a northwesterly direction and then along the east boundary of range 6 to the 3rd base line.

The last work done by this party was the retracement of the Second meridian from the north boundary of township 24 to the north boundary of township 32. This work was begun at the northern end and continued southward, as the facilities for wintering horses were better at the southern end than in the north part. Good progress was made along this line as the bush was light.

Both main levels and check levels were taken. Two levellers were employed in Alberta as the ground was rough, but one leveller did the work in Manitoba and Saskatchewan. Permanent bench-marks made of iron pipe five feet long, about three inches in diameter, filled with concrete and having a flange on the bottom and a brass cap on the top on which is cut the number of the bench-mark were placed at the beginning, centre, and end of each township boundary retraced.

*Party No. 2.—Retracement of block outlines in northern Alberta.*

This party was engaged during the early part of the season in retracing the Fourth meridian from township 88 to township 104; the rest of the season was utilized in making stadia trav-

PERSONNEL:

G. H. Blanchet, D.L.S., in charge.

Assistants—

J. E. Fredette, D.L.S.

D. E. Chartrand, D.L.S.

Leveller—

W. H. Dowling.

Party—

11 employees.

erses of water areas and their connections between the headwaters of Churchill and Clearwater rivers.

The purpose of the retracement surveys was to locate errors known to exist either on this meridian or on the base lines between the Fourth and Fifth meridians.

The base line closings between the Fourth and Fifth meridians are fairly regular until the 26th base line is reached. This line and the two immediately north of it show a shortage of about four chains. The position of the Fifth meridian was checked by block outlines to the west of it and its alignment found to be approximately correct. As no base lines had been run east of the Fourth meridian, it was concluded that either the



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Fourth meridian deflected to the west north of the 25th base or that the 26th, 27th, and 28th base lines were chained too long. The uncertainty in the case of such an important line as the Fourth meridian which forms the boundary between Alberta and Saskatchewan made investigation necessary.

The party reached Methy lake in tp. 87-24-3 on April 28, the spring floods causing some delay. Bridges on several streams had to be repaired and a raft made to cross Christina river.

The Fourth meridian was retraced from township 88 to township 104, as much as nine miles being retraced in a day. Horse feed was scarce and speed was necessary. On the return journey the horses had to be fed the surplus supplies, but two of them died. On the completion of the retracement they were sent out to McMurray.

In addition to the azimuth the line was chained in patches only, on account of the speed with which the line was gone over, but on the return trip all the gaps were completed. The chainage was uniformly long thus confirming the results of the latitude observations at the Clearwater and lake Athabaska. Portions of the 24th to 28th base lines were retraced and in every case the chainage was long, thus accounting for the shortage of the base line. An error of over half a chain was found on the 28th base line where it crosses one of the back-waters of Athabaska river. In the original survey this distance was secured by triangulation but on the retracement it was chained and carefully checked.

Levels were run along the meridian and base lines, the greatest error found being twelve feet on the 25th base line east of the Athabaska.

The retracement work was completed on June 7, and the stadia traverse of the chain of lakes commencing at Methy lake through Methy river, Peter Pond lake, Churchill lake, McBeth channel, Ile-à-la-Crosse lake, Frobisher lake, Turner lake, and Wasekamio lake, was made for the purpose of obtaining an accurate map of these waters and of the islands in them.

The stadia survey of these lakes is entirely different from similar work in surveyed territory. In the latter case ties to existing monuments can be made at least within two or three miles, thus affording a check on the work, but the only lines run in northern Alberta and Saskatchewan are base lines twenty-four miles apart and the large lakes traversed here with their deep bays and numerous islands occupied on one occasion a month to get from one base to another.

Three months were spent on stadia surveys in this locality, during which time 1,400 miles of shore line were defined.

The traverse of Turnor lake presented the greatest difficulty as there is practically no beach, and the shore is thickly timbered with heavy brush fringe. The lake margin is either granite outcrops or large boulders with deep water close to shore. It was often necessary to set the traverse stations in two or three feet of water, and the slippery rock and unusually rough water made work difficult.

Some of the shore lines had a wide border of floating bog on which hubs had to be used for the transit and it was necessary for two men to work together at the transit as walking around it on the soft bog would displace it.

## SUBDIVISION SURVEYS.

The number of parties employed on subdivision surveys was reduced from ten last year to one this year. This was done for the purpose of releasing as many labourers as possible for agricultural and munitions work, the normal number of labourers on a regular subdivision party being about twenty.

*Surveys in Peace River Valley.*

The subdivision made by this party lies in Keg River prairie in the lower Peace River valley. Instead of building a scow at Peace River and floating down to the location of the work, transportation was secured on a river

## PERSONNEL:

J. A. Buchanan, D.L.S., in charge.



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*Assistants—*

T. H. Bartley, D.L.S.  
G. S. Bayly.

*Leveller—*

H. G. C. Becks.

*Party—*

9 employees.

every township being subdivided. Much difficulty was experienced in sinking the survey posts as large boulders and gravel were encountered in seventy-five per cent of the holes and on one occasion a full half day was spent in sinking two posts.

Regular survey work was stopped on October 19, but a small amount of traverse and check levels kept the party busy till October 25.

steamer for what building a scow would cost, thus saving the time of construction. Also four or five days would be taken in going by scow, while the trip by steamer was made in one day.

Survey operations were begun on May 22 in tp. 101-22-5 and continued through seven more townships, the land suitable for settlement in

## MISCELLANEOUS RESURVEYS.

As in former years there were many requests from settlers to resurvey lines defining their boundaries, to establish section and quarter-section corners which were lost and to correct lines which were said to be in error. These requests are confined mainly to the land surveyed many years ago.

*Party No. 1.—Resurveys in Southern Manitoba.*

This party was employed in making resurveys and retracement surveys in southern

## PERSONNEL:

J. E. Jackson, D.L.S., in charge.

*Assistant—*

J. E. Morrier, D.L.S.

*Party—*

7 employees.

Manitoba, and miscellaneous surveys in the vicinity of lake Winnipeg and lake Winnipegosis.

Work was commenced on June 6 with the resurvey of tp. 1-13-E. In this township wooden posts were used extensively to mark the corners in the original survey and many of these posts had entirely disappeared. Standard iron posts were

substituted. Owing to the shortage of labour complete monuments were not erected.

The next work undertaken was the resurvey of tp. 21-2-E., situated close to Chatfield on the Canadian Northern railway, Fisher River branch. Posts without monuments were planted at all corners as in the previous township.

Upon the completion of this work the transport equipment consisting of wagons and horses was discarded and the party taken to Matheson island on lake Winnipeg by steamer. This island was subdivided into lots for the use of the settlers. Work in the vicinity of this lake was completed with the retracement of the boundaries of the Indian reserve at Berens river and the subdivision of the old Bloodvein Indian reserve which was replaced by a new reserve nearer to the mouth of Bloodvein river.

The party returned to Winnipeg and proceeded to Winnipegosis to undertake surveys along lake Winnipegosis. Work was just commenced but had to be abandoned because members of the party were laid up with influenza. Survey operations were closed on November 19, one member having died from this sickness.

*Party No. 2.—Resurveys in Southwestern Saskatchewan.*

Most of the work of this party consisted of the resurvey of isolated townships in the southwesterly part of Saskatchewan. Operations were begun in tps. 20 and 21-29-3 on May

## PERSONNEL:

R. H. Knight, D.L.S., in charge.

*Assistant—*

D. O. Wing, D.L.S.

*Party—*

7 employees.

17, and ended on December 3.

The transport consisted of four horses, a wagon, a democrat, and an automobile.

Some of the islands in Saskatchewan river were not subdivided at the time of the original



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survey. Section lines were run across these, and the heavy bush made progress slow. This was added to by the impossibility of securing help.

*Parties Nos. 3 to 6—Travelling Parties.*

The miscellaneous surveys required were small, numerous, and scattered. Where

## PERSONNEL:

A. E. Glover, D.L.S.  
E. S. Martindale, D.L.S.  
R. B. McKay, D.L.S.  
R. C. Purser, D.L.S.

## Assistants—

Chas. Harvey, D.L.S.  
G. P. Pearson.

## Parties—

One assistant, or one labourer  
to each party.

only a small survey was needed, the surveyor was accompanied by a single labourer. For scattered work travel was by railway. Where a number of small jobs were close together the surveyor was furnished with an automobile. The roads throughout the western provinces were ideal for travel on account of the small amount of rainfall, but this proved detrimental to the crops. The work of the travelling parties consisted of resurveys, retracements, corrections, surveying

townsites, retracing group lots, connecting Dominion land surveys to Alberta and British Columbia boundary survey, taking magnetic observations, etc. Some of the magnetic repeat stations occupied were of long standing, one at Fort Alexander being occupied by Sir John Franklin in 1825, and others of more recent date occupied by members of the Carnegie Institution, the Dominion Meteorological Service, and the Dominion Observatory.

## RAILWAY BELT SURVEYS.

The land in the railway belt suitable for settlement lies mostly on flats or benches along rivers, and being composed of alluvial soil is very productive. As settlement progresses benches higher up have to be surveyed and every year less good or medium land is available for settlement. In districts where the danger from summer frosts is not too great some high benches are settled on if they can be irrigated.

The number of survey parties in the railway belt was reduced to three, as compared with four the previous year.

*Party No. 1—Surveys near Revelstoke, B.C.*

The first surveys made by this party were in the valley of Cranberry creek in

## PERSONNEL:

N. C. Stewart, D.L.S., in charge.

## Assistants—

P. J. Moran, D.L.S., (part time).  
R. F. Dynes, D.L.S., (part time).

## Party—

7 employees.

were also taken along for crossing rivers and lakes encountered as it is almost impossible to ford the swift running mountain streams.

On the survey of the belt limit in tp. 28-1-6 a climb of 3,500 feet was made in a mile and a half and it required eight hours owing to the dense underbrush. No place could be found for a camp at the starting point of the survey and there was no water. Accordingly the party had to move higher up to a snow bank where melted snow furnished water. A three days' rain then set in and four days were required to run half a mile, as many inaccessible cliffs were encountered and an offset had to be run to the valley below. Large trees were encountered six feet in diameter, to fell which seven-foot saws were necessary. Carrying these saws up a thirty-degree slope covered with alder and devil-club is tantalizing work, and felling large trees on the steep mountain sides is very dangerous especially to those working below. In such cases all must



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scramble out of the way and much valuable time is lost. Some narrow escapes were also experienced from rocks which were dislodged higher up the mountain.

During the latter part of the season some bench lands were surveyed in the valley of Eagle river, where the difficulties were small compared with those on the belt limit in tp. 28-1-6.

The final work consisted of a retracement of mineral claims in tp. 23-18-5, which was completed on October 15.

*Party No. 2—Surveys near Ashcroft.*

Before commencing the regular season's work near Ashcroft this party made some small surveys near Agassiz in tps. 3 and 4-29-6 and in tp. 11-26-6. This work was begun on May 21 and completed on June 8.

PERSONNEL:

W. J. Johnston, D.L.S., in charge.

Assistant—

C. T. Hamilton, D.L.S.

Party—

6 employees.

The district around Ashcroft is of a rough mountainous character, although there are some level benches along the streams. Transportation was rather difficult owing to the rough surface, man-packing being adopted where pack trains or wagons could not be used.

Survey operations were closed on October 12.

*Party No. 3—Surveys around Kamloops, B.C.*

Work was begun by this party in tp. 20-19-6 early in June, on the north shore of Kamloops lake. Some of the lines had become obliterated and had to be retraced and a small portion of the shore of the lake traversed. As this work could not be finished on account of the high water in the lake it was left until the last of the season. Much of the land surveyed lies at a high elevation and the surface is rolling mountain plateau most of which has been overrun by fire.

PERSONNEL:

John Vicars, D.L.S., in charge.

Assistant—

James Gibbon, D.L.S.

Party—

7 employees.

Surveys were made in a number of townships and many small lakes were traversed.

Operations were closed on December 8 after completing the retracement of an Indian reserve boundary.

STADIA SURVEYS.

The investigation of water areas in surveyed townships was continued under the same conditions as last year, eleven surveyors being employed. In addition to the examination of water areas the condition of the monuments was noted and where the survey work to be done in any place was small it was completed by the stadia party, thus saving the expense of another party.

Most of the area where these surveys were carried on was subdivided thirty or forty years ago and the plans compiled from these surveys do not now represent actual conditions on the ground as many lakes have partly or fully dried up and others have increased in size. The dried-up beds of the lakes have generally changed to hay meadows and the owners of the adjoining lands wish to acquire title to the dried-up tracts.

*Party No. 1—Surveys in Manitoba.*

The area covered by this party lies between lakes Winnipeg and Manitoba around Shoal lake.

PERSONNEL:

J. W. Pierce, D.L.S., in charge.

The area of most importance examined was the bed of Shoal lake. This lake was originally twenty



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*Assistants—*

J. K. Benner, D.L.S., (part time).  
J. H. Smith, D.L.S., (part time).

*Party—*

3 employees.

miles in length and from two to five miles wide, but at present about two-thirds of the original area is dry, much of it producing hay and some cultivated. In many places roads are constructed across the dry bed. In addition to traversing the present lake it was necessary to run about seventy miles of section line and to erect the same number of monuments in order to extend the subdivision to the water's edge.

In this locality 186 water areas were examined involving the running of 328 miles of traverse. About 90 miles of section lines were run and marked by 95 new section and quarter-section monuments.

Work was begun on May 28 and on October 30 survey of water areas ceased, the party being employed for the remainder of the season on the investigation of lands in the Riding Mountain forest reserve for soldier settlement purposes.

*Party No. 2—Surveys South from Regina.*

The area examined by this party consists of ninety-three townships lying about forty miles south of Regina and Moose Jaw.

*PERSONNEL:*

C. Rinfret, D.L.S., in charge.

*Assistant—*

A. H. King, D.L.S.

*Party—*

3 employess.

Work was begun in tp. 6-3-2 on May 17, and survey operations were closed on November 18.

In all 716 miles of traverse were run and seventy-one monuments were built at corners where sloughs and lakes of the former survey had dried up. The erection of these monuments necessitated the running of ninety-six miles of section lines.

During the first part of the season the weather was dry and many dried-up lakes were found but later in the season more rain fell and lakes were numerous. In townships 14, ranges 28 and 29 west of the Second meridian eighty-two lakes were found, and in the adjoining townships lakes were numerous.

*Party No. 3—Surveys Northeast of Regina.*

About fifty-eight townships north and northeast of Regina constituted the area examined by this party. The Fishing lakes lie

*PERSONNEL:*

P. M. H. LeBlanc, D.L.S., in charge.

*Assistant—*

R. Bruynseraede, D.L.S.

*Party—*

3 employees.

in the centre of this area at the foot of a valley 250 to 300 feet deep. The depth of the water in the lakes is reported to be in places one hundred feet but the greatest depth found by sounding was thirty-eight feet.

A Dominion fish hatchery is located on one of the central lakes.

Work was begun in the Fishing Lakes district on May 15 and finished on August 29 when the survey of Quill lakes was begun. These lakes are the largest bodies of alkaline water in the western provinces, but artesian wells are found at very short distances from the lakes from which pure cold water flows.

Survey operations were closed early in October, 700 miles of stadia traverse being run.

*Party No. 4—Surveys near Prince Albert.*

The whole area covered by this survey lies south of North Saskatchewan river.

*PERSONNEL:*

W. Christie, D.L.S., in charge.

The survey of this district was made many years ago and no accurate record was made of the water areas, for quarter-sections shown on



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Assistant—

J. H. Patterson, D.L.S.

Party—

3 employees.

the plan as containing 160 acres of land had a large portion covered by water.

Survey operations were begun on May 28 and continued until October 19, when stadia work was stopped and the party employed on soldier settlement work for the remainder of the season.

The transport consisted of two teams of horses, a wagon, a democrat, and a saddle horse.

During the season 481 miles of traverse were run, and many small ponds which were not large enough to survey were investigated. A number of magnetic observations were taken.

*Party No. 5—Surveys Northwest of Saskatoon.*

The district in which this party worked consisted of a block of forty-three townships lying immediately northwest of Saskatoon. Most of the area is open prairie but towards the north in the vicinity of tp. 45-8-3 the country gradually becomes covered with bush.

PERSONNEL.

P. J. McGarry, D.L.S., in charge.

Assistant—

A. Fawcett, D.L.S.

Party—

3 employees.

This party organized at Prince Albert and commenced survey operations on May 27. Work was continued throughout the season and on October 14 the party disbanded. During this

period some 580 miles of traverse were run. A portion of Saskatchewan river was traversed. In one township alone, tp. 45-8-3, sixty-five lakes were traversed requiring three weeks of the party's time. The usual methods of survey were followed, and the usual transport equipment of four horses, a wagon, democrat, and car were used.

*Party No. 6—Surveys North and Southwest of Medicine Hat.*

The central part of the area to the southwest lies in Cypress hills. The highest parts of these hills are 4,200 feet above sea-level.

PERSONNEL:

G. C. Cowper, D.L.S., in charge.

Assistant—

C. H. Snell, D.L.S.

Party—

3 employees.

The townships surrounding these hills were surveyed many years ago but no bodies of water were shown on the plans if the area was less than twenty acres. The present surveys include water areas over five acres in area and consequently as small lakes were numerous each

township furnished a great deal of traverse work. The largest of these lakes has an area of about 300 acres and they all appear to be fed by springs.

Work was begun on May 22 and field operations were closed on October 21. No time, practically, was lost on account of bad weather, the season being favourable for surveying. One hundred and fifty-six townships were investigated involving the running of 573 miles of traverse and twenty miles of resurvey.

*Party No. 7—Surveys North and Northwest of Battleford.*

Part of the work assigned to this party consisted of the traverse of part of North Saskatchewan river near Lloydminster,

PERSONNEL:

T. A. Davies, D.L.S., in charge.

Assistant—

W. P. Daly, D.L.S.

and this work was begun on June 3 so that the traverse could be completed before the flood season. The floods came however on June 13 rendering further work impossible. The remain-



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Party—  
3 employees.

der of the season was employed on investigation of water areas in about sixty townships lying north and northwest of Battleford. Over 625 miles of traverse were run before operations were closed on October 10.

The transport consisted of a team and wagon, and an automobile.

In the valley of Battle river many section and quarter-section monuments were missing, and also the course of the river was materially changed through erosion of the banks. The absence of the monuments was due to the presence of lakes and sloughs at the time of the original survey nearly all of which are now dried up. The results of the investigation show that it was urgently needed as well as the retraverse of the changed courses of the river.

*Party No. 8—Surveys Southwest of Stettler.*

The district covered by this party lies in eastern Alberta extending from the boundary between Alberta and Saskatchewan westerly to range 18. Some townships east of the boundary in Saskatchewan were also investigated.

PERSONNEL:

G. A. Bennett, D.L.S., in charge.

Assistant—  
J. E. Gray, D.L.S.

Party—  
3 employees.

Survey work was begun on May 23 in tp. 26-27-3. During the season sixty-five dry lake beds were found which produced hay or were partly cultivated, in eighty-nine others the areas had changed considerably since the original

survey, and two hundred and sixty-five lakes were located which were not shown on previous surveys.

Forty-eight observations for magnetic declination were taken, including five repeat stations which had been occupied in previous seasons. On account of cold and stormy weather operations were closed on November 25.

*Party No. 9—Surveys Northeast of Calgary.*

The investigation of water areas in townships 19 to 32 from range 21 west of the Fourth meridian to range 2 west of the Fifth meridian, and some adjoining townships was made by this party. Many water areas were found not shown on the original plan, but most of them were under twenty acres in area.

PERSONNEL:

W. J. Boulton, D.L.S., in charge.

Assistant—  
K. F. McCusker, D.L.S.

Party—  
3 employees.

Many of the larger lakes in this area are partially dry and others wholly dry. This is partly due to settlement as cultivation prevents run off,

the water being absorbed much more quickly on cultivated land and less water flowing to the old lake beds. The courses of some of the rivers have changed in places as much as half a mile. This is characteristic of rapid mountain streams where erosion of banks is always going on. Frequent traverses of such streams are necessary to keep the township plans up-to-date.

The transport outfit consisted of an automobile, a wagon, a democrat, and four horses.

Survey operations were begun on May 30 and closed on October 22, during which time 1,100 miles of stadia traverse were run.

*Party No. 10—Surveys east of Red Deer.*

The area in which this party carried on stadia surveys lay east of the city of Red Deer and west of Stettler.

PERSONNEL:

W. H. Norrish, D.L.S., in charge.

Operations were begun on May 25 and continued until August 8, when the party was em-



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*Assistant—*

E. Lamert.

*Party—*

3 employees.

ployed on the resurvey of school lands. This resurvey was completed on December 13 and the traverse of Red Reed river was begun, completing it on January 14. This traverse was left over from the early summer as it could be done

much more economically on the ice on account of the brushy character of the shore line.

During the time employed on stadia work over 670 miles of traverse were run including about 100 miles on Red Deer river. Various types of country were encountered ranging from prairie to fairly heavily timbered land, and the methods of survey had to be adjusted to suit the district. The transport during the summer consisted of four horses, a wagon, a democrat, and an automobile, but during the traverse of Red Deer the only transport used was a team and an old caboose.

*Party No. 11—Surveys south of Edmonton.*

The area investigated by this party consisted of ranges 24 and 25 from township 53 south to township 46. Work was commenced

*PERSONNEL:*

H. M. R. Soars, D.L.S., in charge.

*Assistant—*

E. Nelson.

*Party—*

3 employees.

on May 30 and continued throughout the season until December 13 when the party was disbanded. During this period stadia traverse was made of approximately 340 miles and 120 miles of section lines surveyed. Seventy-five magnetic observations were taken and an attempt was made to obtain reliable magnetic observations at the repeat

stations in Edmonton. This was abandoned however as the local attraction was too great. In addition to the regular stadia work during the latter part of the season school land surveys were made which accounts for the large number of section lines surveyed by this party.

Considerable bush lands exist in the townships in which this party worked and this had the effect of slowing down the work somewhat. The methods of survey adopted were similar to those of other stadia parties working in a bush district. The transport equipment consisted of four horses, a wagon, and a democrat.

## RETRACEMENT OF SCHOOL LANDS.

Sections 11 and 29 of every surveyed township in Manitoba, Saskatchewan, and Alberta are set aside as an endowment for purposes of education. When the surrounding sections are settled on and improved the school lands are sold by auction and as they have become very valuable, it is important to have the boundaries well marked and the contents accurately measured.

Six parties were therefore employed for the whole season on this work and two other parties for part of the season.

*Party No. 1—Surveys east and south of Winnipeg.*

This party was engaged in investigating and retracing school lands lying close to the city of Winnipeg. During this period some 151 miles of section lines were retraced.

*PERSONNEL:*

C. H. Taggart, D.L.S., in charge.

*Party—*

1 employee.

The original surveys in this district were made many years ago; in fact they were among the earliest surveys conducted in the western country. Many of the monuments are obliterated or lost.

The lands being situated so close to a large city such as Winnipeg are of great value.



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The surveys conducted by this party were therefore of the greatest importance, and entailed a large amount of retracement of lines to monuments still existing, as well as the erection of many new monuments.

While carrying on these surveys the surveyor was instructed to estimate the value of the school lands affected by the surveys. The estimate was based upon the value of the surrounding lands, due note being made of all sales within the previous few years.

The survey work was actually commenced on June 15, although a number of magnetic observations were previously made at a repeat station in River Park. The transportation equipment used was a team of horses, and a democrat, which was suitable for the work to be done. Work was continued throughout the season until November 11, when both the chief and his helper were stricken with a severe attack of influenza. Very little time was lost due to inclement weather and the fall of the year was almost ideal for survey work.

*Party No. 2—Surveys west of Brandon.*

The retracement of school lands in a block of twenty-seven townships about twenty miles west of Brandon constituted the work of this party.

## PERSONNEL:

J. A. S. King, D.L.S., in charge.

## Party—

1 employee.

Most of the work was in open prairie but a good deal of cutting was necessary which made progress slow with but two men on the party.

Very few of the original monuments were found, and as many of the original settlers have left the place a great deal of time had to be spent collecting evidence of the original surveys. In fact as much time was spent in this way as in actual survey work. A great many monuments were lost and many miles of retracement had to be made to re-establish these corners.

*Party No. 3—Surveys east of Regina.*

The ten townships in which retracement of school lands was carried on lie within thirty miles of the city of Regina.

## PERSONNEL:

L. E. Fontaine, D.L.S., in charge.

## Party—

1 employee.

The season's work which consisted mainly of investigation, retracement, re-establishment of lost corners and correction of monuments was begun on June 7 and ended on December 13.

The last two weeks of this period were employed in taking magnetic observations at repeat stations as the deep frost in the ground at the end of November made mounding on retracement work difficult.

During June and the first part of July the unusually high winds proved a hindrance to the work and the difficulty of securing help was also a serious drawback as with only one man on the party every retraced section had to be travelled three times, transitting, chaining, and then posting and mounding.

As the original surveys were made many years ago many of the monuments have disappeared and the school land section lines had to be followed till a monument on the produced line was found. Also many of the adjoining lands were patented and the owners had to be consulted. This took much time, as often the owners were hard to locate.

*Party No. 4—Surveys around Saskatoon.*

Of the sixteen townships in which school lands' investigation was carried on all were within thirty miles of Saskatoon. On

## PERSONNEL:

J. M. Cote, D.L.S., in charge.

account of the shortage of labour, only one



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Party—  
1 employee.

labourer was allotted to this party, transportation being by means of an automobile.

Work was begun on May 21 and finished on October 30, retracement being made in townships 35 to 38 in ranges 4 to 6 west of the Third meridian, and also in tp. 35-3-3 and tps. 36 to 38-7-3. Duplicate monuments were found on some of the lines and settlers' fences were found along the erroneous monuments.

Numerous bluffs were encountered during the survey which rendered progress slow and additional lines had to be retraced owing to lost monuments. In all 136 miles of section were retraced.

*Party No. 5—Surveys near Vegreville, Alberta.*

During the first part of the season the members of this party were engaged on stadia surveys of lakes between Vegreville and Edmonton, but from August 1 they were employed on the examination of school lands in the same area.

PERSONNEL:

H. M. R. Soars, D.L.S., in charge.

Assistant—  
E. Nelson.

Party—  
3 employees.

The same transport of four horses, a wagon, and a democrat was used and no difficulties were experienced in transportation as the whole area has a fairly uniform surface. Digging holes for the new standard survey posts, however, took much time as the subsoil was so hard it had to be chipped with a bar, and the party being small progress was slow.

Over 100 miles of line were retraced before the close of operations. Observations for magnetic declination were taken whenever possible both on the stadia work and resurvey.

*Party No. 6—Surveys east of Edmonton.*

The area examined by this party consisted of the school land sections in townships 53 to 56, ranges 15 to 18 west of the Fourth meridian and lies almost due east of the city of Edmonton.

PERSONNEL:

D. F. McEwen, D.L.S., in charge.

Party—  
1 employee.

Operations were begun on May 20 and closed on November 18, 143 miles of section lines being retraced. During the first part of the season operations were hindered by wet weather. Owing to scarcity of labour only standard posts were placed to mark corners, but after August 15 an extra man was hired and complete monuments were made.

Almost all the old iron posts of the original survey were removed by settlers who seem to have a mania for doing so, and attempts were made to remove even the new style of post, but without success, as the new post when properly placed is hard to remove. In some cases settlers have taken witness posts as the true corners and built their fences accordingly.

On October 23 the assistant was taken ill and until the end of the season local help had to be relied on.

*Party No. 7—Surveys east of Red Deer.*

During the first half of the season this party was employed on stadia surveys, the retracement of school lands being begun on August 8. The only stadia traversing done subsequent to this date was on bodies of water encroaching on the school lands.

PERSONNEL:

W. H. Norrish, D.L.S., in charge.

Assistant—  
E. Lamert.

Party—  
3 employees.

In the valley of Red Deer river progress was slow as the surface is rough. Back from the river valley the land is so rough that it is fit only



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for grazing. Travel was difficult and the banks of the valley are so steep that it was almost impossible to get horses or automobiles up or down.

The transport consisted of four horses, a wagon, democat, and an automobile, and the varied character of the area covered made transportation difficult as the transport had to be adapted to suit the country.

*Party No. 8—Surveys northeast and southwest of Calgary.*

Before commencing the regular season's work of retracing school lands this party was employed until May 16 reposting the lots in

## PERSONNEL:

C. M. Walker, D.L.S., in charge.

Banff cemetery, as when the cemetery was resurveyed in 1913 the lot corners were marked by wooden posts, many of which were lost or the markings had disappeared.

Party—

1 employee.

The first area in which school lands were investigated consisted of townships 24 to 29, ranges 1 to 3 west of the Fifth meridian. Standard posts were placed at all corners, but on account of the great scarcity of labour it was impracticable to have pits dug. Little time was lost on account of bad weather but several times the wind and dust made progress impossible, the dust being so thick that objects fifty feet away could not be seen.

During the season 315 miles of line were run and 605 posts placed.

## SOLDIER SETTLEMENT SURVEYS.

With a view to securing land for returned soldiers, all vacant lands in northern Alberta within fifteen miles of railway lines have been reserved.

At the request of the Soldier Settlement Board two surveyors were detailed to inspect the lands so reserved in the Peace River and Grande Prairie districts and to ascertain the location of those suitable for settlement. The surveyors were furnished with all available information from reports and maps of previous surveys in that locality so that no time was spent investigating worthless land.

The total number of quarter-sections investigated by these two parties was 17,100: this is equal to an area of 142 miles long by 30 miles wide.

The object aimed at in the examination was to ascertain what amount of land in each quarter-section was suitable for agricultural purposes and what kind of soil it contained. Quarter-sections containing less than thirty acres of open land were not considered as suitable for immediate settlement.

From the information furnished by these surveys a map of the district has been compiled showing in colours the different classes of land. Already over eight hundred of these homesteads have been taken up and indications point to many more being taken in the near future.

Land classified as suitable for immediate settlement had to be fairly level, the soil of first-class quality and the quarter-section had to contain a sufficient amount of prairie land to enable the settler to make a fair start the first year.

Lands considered as fair for settlement included quarter-sections with considerable open prairie but with the top soil partially burnt off, or a part of the area too rough for ploughing.

Lands which could be economically improved comprised the next class. The soil had to be of first quality and the clearing of a large portion fairly easy. Settlers have, in the past, homesteaded such lands with excellent success throughout the western country being satisfied to do a certain amount of clearing before cropping the lands.

Areas classed as hay meadows had to contain at least twenty-five per cent of meadow land producing abundant crops of hay which can be harvested in an average season.



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Areas containing first-class soil but covered with a growth of trees and consequently offering little inducement to settlers were classed as lands requiring extensive improvements.

Grazing lands were also recorded. These lands usually were those too rough for cultivation but which nevertheless were suitable for grazing.

The last class consisted of worthless land and comprised steep rugged hillsides too rough for cultivation or grazing, gravelly or barren sandy land, stony land, extensive bogs, or peaty swamps. These latter may be reclaimed by drainage but under present conditions were classed as worthless land.

The map prepared shows at a glance where these different classes of land are located and as the scale is large it should prove useful to prospective settlers.

In addition to the work done in northern Alberta two surveyors were employed for a short time: W. Christie, D.L.S., for two months investigating townships in the Porcupine forest reserve and J. W. Pierce, D.L.S., investigating townships in the Riding Mountain forest reserve.

*Party No. 1—Examination of lands between Smoky River and Lesser Slave lake.*

The lands examined by this party lie generally within fifteen miles on either side of the Edmonton Dunvegan and British Columbia railway between Lesser Slave lake and Smoky river, and between McLennan and the town of Peace River.

PERSONNEL:

L. Brenot, D.L.S., in charge.

Assistants—

E. F. Gorman, D.L.S.

P. A. Shaver, D.L.S.

J. P. Howe, D.L.S.

Party—

3 employees.

Work was commenced on June 6 and finished on November 12; the number of quarter-sections examined during this period being 9,200. The party was organized and equipped so that lost time in moving from one township to another

was reduced to a minimum. The transport outfit consisted of four horses, ten pack ponies, two wagons, and a democrat.

With the exception of certain settled areas such as those around McLennan, Donnelly, and Peace River, the country is generally covered with brush varying from park-like country to heavily wooded lands. Notwithstanding this, a considerable number of quarter-sections were found suitable for immediate settlement, lands which could be economically improved, or hay lands. Most of these have already been taken up.

The surface is largely covered by bush and the method of examination followed was that suitable to the conditions found. Practically the whole district has been surveyed, and the section lines and monuments fairly easy to find. Each day the chief and each of his assistants undertook the examination of a certain number of sections averaging between four and nine according to the nature of the bush. Each started from a monument on one of the lines and followed a course due east, west, north, or south, using a compass as a guide. Distances were recorded by counting the paces with a tally register, and elevations were recorded with a barometer. As each quarter-section was crossed the explorer checked up on the next monument and the closing errors in bearing and distance adjusted for all the trails, lakes, etc., crossed in that course. All essential topographical information was noted, elevations were recorded at frequent intervals, particularly at all points of noticeable rise and fall; the soil was tested at least every half mile and at changes in the character of the soil; the kind and quality of the water was examined, and the value of the land as well as the cost of clearing was estimated. Each section was crossed at least once and the information gathered, together with the data from former surveys for the boundaries of the section, enabled the surveyor to classify the land with a reasonable degree of accuracy.



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After each day's travels the records were reduced and essential information plotted on township plans upon which had already been entered the information taken from the original survey records. A draftsman was employed for this work and his time was fully occupied. As soon as the plan of each township examined was completed it was sent to the head office where photostat copies were made and forwarded to the Soldier Settlement Board, which in turn forwarded them to the respective land offices for the use of prospective settlers.

On the completion of the investigation the surveyors were engaged for a few months preparing the classification maps. This not only entailed considerable drafting but also necessitated a closely checked examination of the records in the Land Patents Branch for the standing of the land in each township visited. The classification map was prepared and issued in time for the use of the settlers in the spring.

*Party No. 2—Examination of lands between Smoky River and Pouce Coupé prairie.*

The district covered by this party consisted of lands within fifteen miles on either side of the Edmonton Dunvegan and British Columbia railway from Smoky river to Spirit River and Grande Prairie and along the proposed route of this railway from the town of Peace River to Dunvegan.

## PERSONNEL:

S. D. Fawcett, D.L.S., in charge.

## Assistants—

W. E. Lumb, D.L.S.

L. A. VanSkiver, D.L.S., (part time).

W. E. Robinson, D.L.S., (part time).

T. A. McElhanney, D.L.S., (part time).

J. E. Roy, D.L.S., (part time).

## Party—

3 employees.

Some 7,900 quarter-sections were examined during the season, and these lands were very similar to those examined by party No. 1. The organization, transport equipment, and method of examination were accordingly much the same. South of the town of Spirit River are located what are known as the Saddle hills which are

very rough and are covered with thick, and in places, heavy timber. In order to facilitate the examination in these hills the usual method of investigation was replaced by a reconnaissance examination that is, each quarter-section was not visited but a sufficient number of courses were followed to enable the examiners to accurately describe the lands. Where such reconnaissance indicated the possibility of finding suitable lands these areas were examined in detail. This scheme was considered satisfactory because it was not important to locate small isolated areas of suitable lands as the difficulties a settler would experience in gaining access to them rendered them of little value as homesteads. Indeed it was considered preferable that settlement should be excluded for this reason. Two large areas of lands suitable for immediate settlement were located, one northeast of Spirit River in a district known locally as the Blueberry Mountains, and the other northeast of the town of Sexsmith. In addition, many areas suitable for grazing were noted, but only recommended for use of settlers on lands close by.

Work was commenced on June 10, but had to be brought to a close on November 2 when the chief and his three assistants were stricken with a severe attack of influenza. One of the assistants, Mr. Roy, died in the hospital at Spirit River.

## TOPOGRAPHICAL SURVEY OF BOW RIVER FOREST RESERVE.

The photo-topographical survey of Bow River forest reserve which was begun last year was continued, the portion surveyed this year including that drained by Red Deer river and

## PERSONNEL:

M. P. Bridgland, D.L.S., in charge.

## Assistant—

L. E. Harris, D.L.S.

its main tributary, Panther creek. Adjoining the river in ranges 8, 9, and 10, the country is of the foot-hill nature and consists of rolling hills, but



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Party—  
6 employees.

farther west it becomes very rough, the mountains rising above timberline. Glaciers are numerous and in many areas the original forests consisting of jack pine and spruce up to eighteen inches, are still standing. A large area of open land lies on Red Deer river near the mouth of Bighorn and Scalp creeks which was formerly used as a horse ranch. Trails are numerous, many of them being mere hunting trails but some are passable for wagons.

Traverses on which reference posts were planted at intervals were carried on in addition to the photographic work, the traverse courses following the streams and gravel bars as far as possible in order to avoid cutting.

No mineral except coal was found, some coal locations being staked on the west branch of Panther creek, between the forks and Windy cabin.

#### LEVELLING.

The amount of levelling of all classes carried out during the past year was 1,370 miles. About the same mileage of control levels was run as in the previous season but there was a decrease of more than 2,000 miles in subdivision levels due to the employment of only one party on that class of surveys as compared with ten parties in the preceding year.

No meridians or base lines were surveyed during the year, but levels were taken by one party employed on retracing base lines and meridians in Alberta and Manitoba. The leveller was simply a member of the party and had, therefore, to adapt his work and speed to the general progress of the other survey work, an arrangement which cannot develop nearly so good results as when the leveller has a party of his own.

Only one party was employed on subdivision surveys. This party levelled 274 miles. Such levels in the north are always commenced from the nearest base line levels and ultimately extend across the intervening area to the next base line. As each base line has been levelled independently of the next one, some discrepancy is bound to exist between the two, more especially near their westerly ends. The subsequent connection through subdivision is not suitable for adjustment so that temporary arrangements have to be made until some line of precise or secondary levels can be run so as to intersect and correct the base lines.

The number of miles of the various classes of levels run during the year and the total at the end of the year are as follows:—

	Season, 1918.	Total.
Precise levels...	308	3,447
Secondary levels...	407	1,405
Meridian and base line levels...	381	12,268
Subdivision levels...	274	6,967
Other lines of levels...	....	321
Totals...	1,370	24,408

(In addition, 60 miles were relevelled along the 25th base line west of the Fourth meridian.)

#### *Party No. 1.—Precise levels from Weyburn to Govenlock.*

This line of levels was run along the Canadian Pacific railway through the southern part of Saskatchewan from Weyburn to Govenlock.

##### PERSONNEL:

J. B. Alexander, D.L.S., in charge.

Assistant—

S. C. Akins.

Party—

5 employees.

The work was carried on in accordance with the general instructions for precise levelling. During the last part of May, and June and July the wind was exceptionally high, railway cars being overturned by it. This interfered considerably with the progress of the work, but after August 1 no time was lost on this account.



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The elevations of 264 road allowances and the rail elevations of 44 railway stations passed were recorded. Ninety-eight permanent bench-marks were established, and connection was made to a line of levels along the Third meridian, to a line along the 2nd base line west of the Third meridian, and to a bench-mark established by the Irrigation Branch on the left bank of Frenchman river, about a mile east of Eastend station.

Considerable difficulty was experienced in building bench-marks of concrete as water had to be carried a mile in almost every case and gravel had to be shipped ahead in sacks.

*Party No. 2—Secondary Levels along Township Outlines.*

As this line of levels was run along township outlines the same precision was not required as on a line of precise levels along a railway.

## PERSONNEL:

R. H. Montgomery, D.L.S., in charge.

Assistant—

A. H. Melville.

Party—

7 employees.

Work was commenced on June 12 at the 2nd base line and levels run south to the international boundary along the east boundary of range 13, west of the Second meridian. Levels were then taken north from the 2nd base along the east boundary of range 13 until the 11th

base line was reached. Further progress was prevented by continuous bush, and operations were closed on October 15.

Two independent lines of levels were carried forward, one by the leveller and the other by the assistant.

The main line which included the record of the elevations of natural features was always run in a forward direction while the check line was run in the opposite direction, as much as circumstances would permit. The elevation of the surface along the line was recorded at least every quarter mile. Connections were made to three precise lines of levels, namely, at Halbrite on the Canadian Pacific railway; at Kelliher on the Grand Trunk Pacific railway, and at Kylemore on the Canadian Northern railway. Two lines of secondary levels were also connected, namely, the 2nd and 9th base lines. Elevations were also taken of the top of the rail in front of stations on nine different railways, besides the water level of six larger lakes and three rivers.

The permanent bench-marks consisted of a two-inch iron pipe four feet long with a brass cap and an iron foot-plate seven inches in diameter, planted on line, with the cap six inches above the ground and at intervals of approximately four miles. Sixty such bench-marks were placed. These were placed on the highest rise adjacent to a corner monument, but at no fixed distance from a corner.

The first part of the season was very windy and very hot, as high as  $118^{\circ}$  being recorded on the levelling rod. This greatly interfered with accurate work. A frost on July 24 was followed by a month of rainy weather during which much time was lost, but after August 24 no time was lost on that account.

*Party No. 3—Secondary Levels along Base Lines.*

The 11th base line was levelled from the Fourth to the Fifth meridian, the datum used being the precise level lines along the Canadian Pacific railway crossed by the line in range 26.

## PERSONNEL:

L. O. R. Dozois, D.L.S., in charge.

Assistant—

H. E. Read, D.L.S.

Party—

6 employees.

The line was run westerly from the railway to the east shore of Gull lake and then easterly from the railway to the Fourth meridian.

The levelling of this base line closed a four-sided circuit of 414 miles, 246 of which are



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precise levels, and the remainder secondary levels. The closing error of the circuit is 0.46 feet.

In accordance with the instructions governing secondary levels, permanent bench-marks were established at intervals of not less than  $3\frac{1}{2}$  miles and not more than  $4\frac{1}{2}$  miles. Ridges were chosen as sites for bench-marks in preference to hollows so as to minimize the disturbing action of frost. Bench-marks were invariably placed directly under wire fences, excepting in open country where fences had not been put up, to guard against accidental damage such as the impact of a wagon wheel.

The elevation of the ground was recorded at every quarter mile besides taking in all natural features, such as lakes, sloughs, streams, etc. The line crossed 125 sloughs only 35 of which contained water, and half the creeks were dry.

Branch lines of levels were run to five railway stations in the vicinity of the line.

The last work done was on November 29 and the party was disbanded the following day.

#### SETTLEMENTS AND TOWNSITES.

A topographical survey was made of the proposed townsite at the north end of the main Waterton lake. The lake which is about seven miles long extends for one-third of its length into the Glacier National park of the United States. Applications for the most valuable of the lots in the proposed townsite have already been received by the superintendent of the park.

A survey was also made of a settlement at Carcajou point in tp. 101-19-5. A number of squatters are located there and the lots they occupy had to be surveyed for dealing with their claims.

#### MINERAL CLAIMS.

Continued activity in the mining camps of Manitoba has stimulated prospecting in the mineral areas and many claims have been surveyed during the year. The principal centres are at Flinflon and Schist lakes north of The Pas along the boundary between Manitoba and Saskatchewan where exceedingly rich copper ore is being developed. At Herb or Wekusko lake the mineral is gold-bearing quartz and in the Rice lake district east of lake Winnipeg gold-bearing quartz is also found. The returns of survey of sixty-four claims were submitted to the Department from these districts.

#### CONTROL OF SURVEYS.

*(A. M. Narraway, D.L.S., Controller of Surveys.)*

The controller left Ottawa on May 5 to undertake the field work. His first work consisted of an examination of several survey parties working in southern Alberta and southern Saskatchewan. This trip was made from Edmonton by automobile and occupied fifteen days.

The next trip was through the Peace River country, extending to Fort Vermilion, where parties engaged on land investigation and subdivision were visited. Returning to Edmonton he then visited parties working in Manitoba on resurveys and revision of water areas. Returning again to Edmonton several parties were visited in that vicinity engaged on school land surveys and the revision of water areas. The railway belt in British Columbia was next visited and the work being done by subdivision surveyors there examined.



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In addition to the time spent in visiting survey parties the controller was called upon to devote considerable time to assisting the Soldier Settlement Board, two trips being made through the Peace River country during July and August accompanying the commissioners on trips of land investigation. Throughout September and the early part of October the controller organized two parties for the investigation of lands in the Porcupine and the Riding Mountain forest reserves.

These parties examined over 400,000 acres of land in these reserves which have since been withdrawn for soldier settlement.

From November 5 to November 22 the controller was confined to bed with an attack of influenza, which was then so prevalent throughout the western country, and upon recovery returned to Ottawa, reaching there on November 26.

During the winter months in addition to his usual duties he supervised the preparation of maps, sketches, and reports for the Soldier Settlement Board.

*(G. J. Lonergan, D.L.S., Inspector of Surveys.)*

The first work done by the inspector was the examination of the horses left in winter quarters from the previous season to see if they were fit for the season's work. This inspection was begun at Prince Albert on April 25 and on May 8 the inspection at Morley, Melville, and Lethbridge was completed. About a month was spent assisting surveyors to organize by helping them to secure members of their parties, purchasing supplies, and arranging for forwarding the same. Another month was spent collecting and disposing of horses and outfits that were no longer needed and on July 14 the inspection of the survey parties was begun.

Twenty-four parties in all were inspected, consisting of two parties investigating lands, four parties retracing school lands, three parties on miscellaneous surveys, two parties on subdivision, two levelling parties, and eleven parties on revision of water areas. As these parties were located at widely different points an automobile was used for travelling. The total distance travelled was about 5,000 miles, as much as 200 miles being covered in one day. The inspection consisted of an examination of the instruments used on the survey, the efficiency of management of the party, the examination of the work done, the transport, accounts, diary, field-notes, and other records, and a discussion of the methods used by other surveyors on similar work which proved to be advantageous.

The influenza epidemic put a stop to operations on November 19 as most of the towns were quarantined and further progress was rendered impossible.

## ALBERTA AND BRITISH COLUMBIA BOUNDARY.

A departure was made from the method followed during the preceding years.

## PERSONNEL:

R. W. Cautley, D.L.S., Commissioner for Canada and Alberta.

A. O. Wheeler, D.L.S., Commissioner for British Columbia.

## Assistant—

A. J. Campbell, D.L.S.

## Party—

13 employees.

While Mr. Wheeler was employed on the same work as formerly Mr. Cautley located the boundary in the Peace River district.

Mr. Wheeler made a photo-topographical survey of the boundary in Bush pass, Thompson pass, and the portion of Howse pass remaining unfinished from the previous season.

North of Howse pass the boundary describes a curve southward to Mt. Mummery and then follows a general northwesterly direction. The most striking feature of this section is the numerous

bodies of ice and snow that are accumulated along the crest. On the eastern slope the forest is less dense with wide tracts of wide grassy slopes, and trails are numerous as they can be easily located. On the western slope the valleys are deep and narrow and difficult of access. The trails are little travelled and are almost obliterated by over-



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growth and windfall. Much of the timber on both sides of the watershed is of merchantable value but the cost of transporting it to a manufacturing centre is prohibitive.

The necessity for locating the 120th meridian, the boundary between British Columbia and Alberta north of where the summit of the Rocky mountains crosses this line, was the rapid development of the Pouce Coupé district in that vicinity. In 1917 the longitude of a pier in tp. 77-14-6 was determined by a series of observations by an observer from the Geodetic Survey staff at Ottawa. This point was found to be 415.518 chains west of the 120th meridian. After the initial point had been established by Mr. Cautley he ran the boundary south through townships 77, 76 and 75 to a point about one and one-half miles south of the Grande Prairie and Fort St. John wagon road and telegraph line. Connection of this survey was made with the monuments of the Dominion land surveys. The temporary boundary formerly determined was found to be 18.304 chains too far west.

Since the object of the survey is to establish the location of the boundary on the ground as clearly as possible, monument sites were chosen with a view to their visibility from either direction of the line, subject to a maximum distance of 100 chains.

The district crossed by the boundary is well suited for farm settlement. The soil is fertile and the timber, while large enough for domestic needs is easily cleared. Stock would have to be fed for four or five months on account of the deep snowfall, but the heavy growth of wild grasses, pea-vine, and vetch furnishes excellent winter feed.

## PART II—OFFICE WORK.

### SUPERVISION OF FIELD WORK AND ACCOUNTS DIVISION.

The work of this division has to do principally with the preparation of the scheme of surveys to be undertaken and the drafting of instructions for surveys to the surveyors in charge of parties; the number of such instructions was 245. A record was kept of all requests for surveys, and investigations were carried out in each case as to the need of such surveys, the findings being recorded in tabulated form. One hundred and twenty applications were received. Two hundred and ninety-one other requests which had reached this office during the previous year were also investigated and the surveys recommended or refused as the investigation warranted.

The trend of settlement as indicated by departmental or other records was closely followed, as well as the development of mineral and other industries. The information thus collected was used in the preparation of the scheme of survey operations and the parliamentary estimates.

Forty-five applications for employment as surveyors, assistants, articled pupils or levellers were received and filed for reference in making recommendations to the Civil Service Commission for appointment to the various positions.

Accounts of surveyors for the expenditure connected with their surveys numbering forty-one were examined and audited and when found satisfactory were passed for the approval of the Surveyor General. Eight hundred and eighty-two additional accounts for the general expenses of the branch were audited and passed or rejected. The total expenditure was in the neighbourhood of \$500,000.

Fourteen claims for compensation for accidents, sickness, loss by fire, etc., were reported upon for the consideration of the minister.

As survey outfits are owned by the Department, a record was kept during the year of their distribution, of repairs, renewals, purchases, sales, loss or discard of parts, etc. The correspondence in this connection with surveyors and warehouse keepers was extensive.



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The attendance, sickness, and absence records were kept for the entire staff of the head office in Ottawa, numbering over 150, as well as similar records for the field staff while at office work in Ottawa preparing notes and returns of their surveys.

## SURVEYS INFORMATION DIVISION.

Although less new township subdivision surveys were carried on than during the preceding year the work in other directions increased. Resurveys in connection with the sale of school lands were undertaken for the first time while the number of small miscellaneous surveys was considerably greater. As much more work is involved in preparing the data for resurveys than for new subdivision, the number of plans sketches, and maps prepared for the instruction of the surveyors in the field was nearly fifty per cent greater than for the previous twelve months.

The technical correspondence relating to surveys carried on with other branches and departments of the federal and provincial governments, with surveyors, law firms, settlers, etc., fell off somewhat during the war on account of the decreased settlement in the western provinces. Since the cessation of hostilities, however, it has steadily increased. The questions dealt with are those of conflicting surveys, disputed boundaries, etc., and the work involves the preparation of a considerable number of plans and sketches. A large number of sketch plans were also prepared for the various provincial governments in the western provinces for the information of their surveyors in the field.

In addition to the annual report of the branch, "The Description of and Guide to Jasper Park" was issued during the year. This guide book for tourists which is based on photographic surveys by M. P. Bridgland, D.L.S., is profusely illustrated and is an unusually fine specimen of the printer's art.

## EXAMINATION OF SURVEY RETURNS DIVISION.

Owing to the increasing intricacy of surveys from year to year and the reduction of the staff due to war conditions, it still required the full year to complete the office work of the field season.

Fewer stadia surveyors than in former years assisted with the preparation of official plans of their work.

Since all the surveyors have been required to submit their original records of a survey along with the copies that are examined for filing in this department the examination of the survey returns has proceeded more satisfactorily. A higher standard of work in the field has developed; the final returns submitted for examination have been made with greater care and the examiner is able to refer to the original records for the explanation of all errors found in the final returns, for information omitted, or to correct discrepancies, instead of writing to the surveyor for a more or less satisfactory explanation.

The progress report received from surveyors to the number of one thousand and one were examined.

Owing to the increased activity in the mining districts of Manitoba the returns of survey of sixty-four mineral claims were received for examination.

Provincial road plans to the number of 479, having a total mileage of 688, were received and examined. The several thousand Saskatchewan road plans previously received did not bear the number under which they are registered in the respective Land Titles offices. The registration numbers have been obtained from the provincial authorities and are being added to the plans filed here. This work has not yet been completed. Thirty railway plans comprising 433 miles of line were examined. In several cases more than one copy of the plan was submitted for examination, the total number of plans being 48 and the gross mileage 796.



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The proportion of the British Columbia-Alberta boundary dealt with was the delimitation of the meridian of  $120^{\circ}$  longitude in the Peace River district across townships 75, 76, and 77 range 13 west of the Sixth meridian.

Some 650 requests for information concerning surveys from other branches of the department and from the public were dealt with, in connection with which 275 sketches were prepared and 1,500 areas were calculated and furnished.

#### DRAFTING AND PRINTING DIVISION.

##### *Township Plans.*

These constitute the largest part of the work. During the year 772 such plans have been prepared. Almost every step in the process has been standardized and systematized so that the simple, regular township plan presents no difficulty and is quickly dealt with. Printed forms are used requiring only the addition of topography and the description and numerical data. Townships in part irregular are copied on pale blue forms which serve as a guide for drawing such parts as are regular. The blue form does not photograph where it is departed from in the irregular portions.

##### *Miscellaneous Surveys.*

These comprise settlements, Indian reserves, timber berths, villa lots, subdivisions, and townsites. Nine such plans were dealt with during the past year.

##### *Special Editions.*

When plans of a small portion of a township are urgently needed it is sometimes advisable to issue a special edition of just enough copies to allow those directly interested to obtain one each. Usually six copies are sufficient and this number is made by hand. Sixteen plans have been put through in this way.

##### *Type Printing Jobs.*

Almost every map or plan requires some printing from the small type press used for this purpose, the titles and foot-notes being added in this way. Besides this regular work the press is used to print the type for many forms and tables for office use, such as sketch forms, index cards, field books, forms for calculation, and tables of results. The advantage of printing this class of work by the lithographic process lies in the fact that while the type matter in such jobs can be done easily enough on the type press the ruling is usually too complicated. Sixty such jobs were printed during the year.

##### *Miscellaneous Jobs.*

All classes of work arising in the branch which call for either drafting, stamping with type, or printing with type on the type press naturally come to this division for execution. These jobs are difficult to classify because they are so varied in character. They include the following: 13 commissions for Dominion Land surveyors; 2 certificates for artied pupils; extending graduation on 51 levelling rods; 12 miscellaneous tracings; 6 plans to accompany orders in council; mounting 86 maps; numbering and indexing 1,045 maps for the Geographic Board of Canada; one drawing of apparatus; and 72 other miscellaneous jobs.



## SESSIONAL PAPER No. 25a

*Distribution of Sectional Maps and Files.*

In connection with the sectional maps of Manitoba, Saskatchewan, Alberta, British Columbia, and Yukon Territory which are stored in the floor above the drafting room, the following work was attended to:—

1. When new editions were printed, copies were mailed according to mailing lists.
2. When bound volumes of maps were required, the maps were arranged and prepared for shipment to the bindery.
3. Requests for maps were attended to as received.
4. Stock was taken monthly and steps taken to replenish where necessary.

In the same storeroom are kept old files of correspondence. These were given out as called for.

## SECTIONAL MAP DIVISION.

At the beginning of the year 129 sheets of the sectional maps had been compiled. Fifteen of these were revised and eight others are in hand. Three new sheets, namely, Dillon No. 467, Methy No. 517 in northern Saskatchewan, and Chipewyan No. 666 in northern Alberta are also in hand.

The method heretofore used of making the same projection do for four sectional maps has been abandoned as lacking in accuracy and a separate projection showing township outlines is now made for each sheet. The information gathered from township plans, sketches, field-books, reports, railroad plans, road diversion plans, etc., is all reduced to the same scale, namely, one inch equals two miles and transferred to the projection. The necessary adjustments are made and the whole finally inked in. This compiled sheet is then photographed on the same scale and a number of copies are made in blue lines on heavy Joynsen bond, and in black lines on light Joynsen bond. These latter are sent to the Levelling Office at Calgary where contour lines are marked on them if the information in regard to levels in the district warrants it. When the plan with contours has been returned from Calgary the whole is ready to place in the hands of the draftsman who uses as the basis for the finished copy one of the blue line copies on heavy paper above referred to.

The Stanley pantograph which has been in use for many years was replaced by an Ott Suspended Precision pantograph,—bars thirty-eight inches, with which reductions and enlargements can be made in all ratios between 20·1 and 1·1.

The township reports received from the surveyors for the year from April 1, 1917, to March 31, 1918 were prepared and printed in four pamphlets containing 112 pages.

The examination of the returns of surveyors with a view to preventing duplication of names of topographical features, to eliminate unsuitable names and to establish spelling approved by the Geographic Board, has been continued. The returns examined consisted of 29 general reports, 284 field-books, and 2,033 plans and sketches. The necessary correspondence which was considerable was drafted in this division.

A change has been made in the method of producing the original drawings of sectional maps by having the lettering stamped with printer's type instead of being written by hand. This method is satisfactory and it relieves the draftsmen of a lot of slow tedious work thus economizing their time to a considerable extent: three young ladies have been added to the staff to do the stamping.

The appearance of the sectional maps has been much improved by applying, as far as practicable, the "Resolutions of the International Map Committee."

In addition to the sectional maps, some of the interprovincial boundary maps and an ethnographic map of Europe were drawn for photozincographic printing.



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## SPECIAL SURVEYS DIVISION.

*Base Line Surveys.*

Instructions were prepared for the surveyors employed during the season on base line surveys and the usual field correspondence and checking of the closings carried out. As the field work for 1918 included the establishment of a portion of the Manitoba-Saskatchewan boundary line through the centre of a rich mining district north of lake Winnipeg it was necessary that the preparatory work in the office should be carefully done. In the high latitudes in which recent base line surveys have been made it is necessary, in order to make the computations in such cases with the required accuracy, to have an intimate knowledge of all the surveys in the Dominion Lands system to the south as they are on the ground. The office work which has for some time been carried on in connection with the investigation of base lines and positions of corners throughout the Dominion Lands Surveys system becomes in such cases of special value.

*Retracement of Old Bases and Meridians.*—The office work in connection with the retracement of 354 miles of old base lines and meridians involved the drafting of instructions for the work, the field correspondence during the season, the examination of the final returns, and computing the positions of monuments in the Dominion Lands System from the retracement returns.

Previous to 1918 the geographical co-ordinates of monuments in southwestern Alberta were not known with as high a degree of accuracy as those in other portions of the system. The retracements made in that section of the country during the season have produced excellent results, and the positions of corners have now been accurately determined.

East of the Principal meridian deflections were known to exist in portions of each of the two bases. Positions of monuments on the ground therefore differed considerably from those recorded in the survey returns. The retracements made during the season over these two lines have corrected this condition.

Uncertainty as to whether or not a slight bend existed in the Fourth meridian to the north of township 88 was removed by the retracement made over a portion of the line. The Fourth meridian forms the boundary line between the provinces of Saskatchewan and Alberta. It is also the central meridian of the Dominion Lands Surveys system. It was therefore important that no doubt should exist concerning the positions of monuments thereon. The retracement returns show that the uncertainty was caused by slightly long chainage on portions of some of the bases west of the Fourth meridian which run through a district the nature of which renders accurate survey operations most difficult, and that no bend exists in the meridian.

*Astronomical Work.*

*Azimuth Observations.*—All the azimuth observations taken on the survey of governing lines during the season of 1918-19 have been examined and tabulated and the bearings in the field notes compared with the results.

The survey work was of a miscellaneous nature, comprising surveys of base and meridian outlines; the survey of the meridian of  $120^{\circ}$  west longitude which is the boundary between British Columbia and Alberta in that district; the retracement of a part of the Fourth meridian which is that of  $110^{\circ}$  west longitude; and the retracement of various township outlines in Manitoba and Alberta. Altogether about 280 observations were taken at 112 stations. This is a small number for the number of men employed—four—but two of them were on line work only a short time.

The average range in seconds between the different observations at one station, over all the observations, is eleven seconds.



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A comparison of the observations and line work on the survey of new meridians and base lines, with the observations and line work in the carrying on of retracement surveys, makes it evident that such lines as initial meridians where no deflections occur and base lines where the deflections are not numerous and are regularly provided for are run much more accurately than retracement surveys where deflections frequently occur to keep within old cuttings or to follow the old lines. Lines can be produced much more accurately in this way than is possible by deflections by means of angles or offsets, and surveyors should use every precaution in the turning and reading of angles and in the measurement of offsets and the setting of offset pickets.

Retracement surveys to have the same value in accuracy as the survey of governing lines should be made as far as possible along direct lines and in easy districts where few deflections will be necessary.

*Astronomical Field Tables.*—The four sets of tables for the position of Polaris and the table giving the right ascension and declination of the sun were computed and printed as usual. Two of the former give the azimuth of Polaris for every twentieth township while the other two give it for every second degree of latitude up to  $56^{\circ}$ . The periods covered by these tables are:—

October 7 to December 18, 1919,

August 16 to October 8, 1920,

June 2 to August 18, 1921

and

December 18, 1919, to March 11, 1920,

March 12 to June 2, 1921.

*Magnetic Work.*

In 1918, thirty surveyors were instructed to observe for magnetic declination, and each surveyor was supplied with a list of stations founded previously in the neighbourhood of his work, at which repeat observations might be made. Some thirteen hundred declination observations including over two hundred and fifty repeat observations were obtained during the season. On the surveys of R. C. Purser, D.L.S., and E. S. Martindale, D.L.S., observations for magnetic dip and total force were taken at twenty-seven stations including twenty-two repeat stations founded by the Meteorological Service of Canada, the Carnegie Institution of Washington, and the Dominion Observatory.

These observations for magnetic dip and total force with the results obtained from the repeat observations were published in the May-June, 1919, number of the *Journal of the Royal Astronomical Society of Canada*. The results obtained in 1917 at some twenty-six stations were published in the April, 1919, number of the same journal.

These repeat observations have enabled us to bring all our data up to date and compile a set of isomagnetic charts as follows:—

1. Lines of Equal Magnetic Declination and of Equal Annual Change in Western Canada for 1917.0.
2. Lines of Equal Magnetic Inclination in Western Canada for 1917.0 and of Equal Annual Change between 1912.0 and 1917.0.
3. Lines of Equal Magnetic Horizontal Intensity in Western Canada for 1917.0 and of Equal Annual Change between 1912.0 and 1917.0.

All observations for declination, dip, and force have been reduced to International Magnetic Standard by direct comparison at the beginning and end of the season with the magnetic standards at the Magnetic Observatory, Agincourt, by courtesy of the Director of the Meteorological Service of Canada. The declination observations have been reduced to mean-of-month by direct comparison with the continuous declination magnetograms of the Magnetic Observatory of Meanook, Alberta, supplied by the Director of the Meteorological Service of Canada.



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*Surveys Laboratory..*

Tests were made of 78 D.L.S., transits, 12 levels, 2 compasses, 108 aneroid barometers, 6 surveying cameras, 49 watches.

Of the 49 watches submitted to test 25 were for the regular test and 24 for the short test. Of the former 2 stopped during the test, and of the 23 remaining 6, that is, 26 per cent passed the test.

During the year 77 stadia correction cards were computed, printed and issued to the surveyors.

At the Comparator building, the lengths and weights of 14 tapes of all kinds were determined. Also 301 standard tapes and 92 standard wires were compared with the base.

The comparator base was verified 54 times by the standard four-metre rule.

Two comparisons of the standard four-metre rule with the standard one-metre rule were made.

The work of the Surveys Laboratory is given in more detail on page 36 of this report.

*Surveying instruments.*

Repairs were made to 48 transits, 32 levels, 9 stadia rods, 10 levelling rods, 7 aneroid barometers, 8 kodaks, 4 surveying cameras, 4 instrument cases, 8 tripods and 56 miscellaneous instruments.

Fourteen sidereal watches were overhauled and readjusted.

In connection with the inspection of instruments and outfitting of surveyors, 194 cases aggregating 5 tons, (10,044 pounds) were shipped from this office and 182 cases weighing 9,939 pounds received.

A statement of instruments on hand on March 31, 1919 showing also the instruments purchased and sold during the year is given in Appendix 5 of this report.

*General Work.*

*C.P.R. traverse retracement.*—The field returns of the C.P.R., traverse retracement which were checked during the past year disclosed an error of 5.55 chains in latitude and 5.55 chains in longitude in the original C.P.R., traverse survey in tp. 24-10-5. In consequence of this error the surveys made along the line of the railway through ranges 10 to 19 are in erroneous positions, and it became necessary to fix on the most suitable method of adjusting the surveys for this error. In determining where and in what manner the adjustments should be made between the surveys already carried out and those which may in the future approach or proceed from them, it seemed advisable to be guided to some extent by the topography, and have the adjustments made along lines where the country is most mountainous, and where the excesses or defects of chainage, and deflections of adjusting lines would cause less inconvenience than they would if the adjustments were made in valleys suitable for agricultural purposes. In proceeding by this method about 50 townships were involved. The positions of lines already surveyed in these townships were first sketched in on a plan, and with this as a basis, the positions of lines which may in the future be surveyed to or from them was worked out on the plan according to the method already explained. The amounts by which the adjusting lines should vary from theoretic in bearings and chainages were then computed in detail for each of the townships in the block affected.

*Alberta—B.C. boundary sheets.*—Computations were made for determining latitudes and longitudes for a number of the sheets issued by the Interprovincial Boundary Commissioners engaged on the survey of the Alberta-British Columbia boundary. This involved considerable work in some cases, as at that time the southern portion of the Fifth meridian had not been retraced and the computations had to be carried through from several directions and from comparatively distant points in order to obtain a check on the figures furnished for the boundary sheets.



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*Miscellaneous.*—The subject of survey posts received some consideration in regard to new designs, methods of planting, etc., for the future. Some correspondence was exchanged with the Department of Lands Forests and Mines of Ontario, and the Department of Public Works of Manitoba in regard to survey posts they intended having made. Samples of the work in different stages of completion and an explanation of the processes of manufacture, inspection, and planting were supplied. Engraved brass plates for concrete monuments were supplied for the Alberta-British Columbia Interprovincial Boundary Survey.

A general review is being made of methods of rapidly solving the astronomical triangle for time-azimuths and altitude-azimuths, covering tables, solar attachments, calculating devices, slide rules, abaci, nomograms, etc. This interesting matter has been greatly delayed, but will now receive more consideration.

A nomogram was designed and published entitled "Nomogram Showing Duration of Sunlight for Every Day in the Year for All Places in Canada between latitude 42° N. and 60° N." An explanation and discussion of this was inserted in the Journal of the Royal Astronomical Society of Canada, 1919. Investigations were made concerning hours of sunshine, hours of solar insolation, meteorological conditions, etc., of the Peace River district in comparison with localities farther south, for the agricultural season.

Mechanical drawings were made covering a special sectional stadia rod, and the rod was manufactured.

## PHOTOGRAPHIC OFFICE.

The surveyors on the more level ground realize the importance of carrying a small camera with their outfit and for this season's work they were furnished with a small size pocket kodak with a Tessar lens. The most important pictures will be enlarged to about 5" x 7" if desired for publication, while the smaller ones will be attached to the surveyor's report.

In the photo-zincographic department the remaining staff was worked to capacity owing to further calls for military service; nevertheless the gross amount of work is slightly higher than the previous year.

The demands of other branches on our office have continued to increase: they cannot be fully met until the staff is restored to normal strength.

The average number of township plans and sectional maps was put through, and also a considerable number of reductions for projection for the engraving department of the Printing Bureau.

A number of line etchings were made for various departmental publications.

Details and figures of the work executed are given in appendix No. 4.

## LITHOGRAPHIC OFFICE.

A comparison with the previous year shows a decrease of about twenty per cent in the number of maps, plans, and forms, a decrease of about thirty-eight per cent in the number of copies, and a decrease of about fifty per cent in the number of impressions. In view of the scarcity and enormous cost of paper the number of copies was reduced to a minimum. The number of impressions depends on the number of colours. The reduction of fifty per cent was obtained by omitting colours when possible and substituting some other distinctive mark.

The number of township plans and sectional maps printed by this division during the year was reduced to a minimum and the number of copies of each plan and map was also reduced.



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Sundry jobs increased over the previous year, due chiefly to the printing of numerous small reference maps and plans used by compilers and draftsmen, the number of copies of each never exceeding ten.

Forms used on surveys and at the head office, skeleton plans to be inked in by the draftsman, the index map, a few topographical and other maps, and charts of reorganization for this and many other branches were also printed.

The cost of this work estimated at Printing Bureau rates, or what it would have cost the Government to have had the work done through the Bureau is shown in the following table as well as a comparison with the cost of the previous year.

Item.	Number printed.		Cost at Bureau Rates.	
	1917-18	1918-19.	1917-18.	1918-19.nn
			\$ cts.	\$ ctr.
Township plans.....	1,036	736	35,506 90	22,619 50
Sectional maps.....	66	57	5,344 11	4,575 30
Sundry jobs.....	173	232	20,590 46	10,963 71
	1,275	1,025	61,441 47	38,158 51

Adding to this the cost of the paper and percentage for handling allowed by the Bureau (\$4,174.45), would give a total of \$42,332.96.

The actual cost to the department for maintenance of this division compared with that of last year is as fallows:—

	1917-18.	1918-19.
	\$ cts.	\$ cts.
Process photographers. ....	7,212 92	7,499 91
Lithographers.....	23,922 77	24,056 44
Total.....	31,135 69	31,556 35
Value of work at Bureau rates.....	61,441 47	42,332 96
Profit.....	30,305 78	10,776 61

The above figures do not take into account the saving in the preparation of originals for reproduction. If the printing were done outside, the originals would have to be more elaborate.

It will be observed from the above schedules that the cost of maintenance of the division varies very little from year to year, as the staff generally remains the same, and the amount of paper used from year to year is fairly uniform.

The difference of almost \$20,000, however, in the value of work at Bureau rates is explained by the fact that in 1917-18 a great number of high class maps were printed of Jasper Park, surveyors sketch maps, and maps for the Geographic Board index, the work on which was very expensive, a dozen of the maps running as high as \$70 each. This accounts for the drop in profit from \$30,305.78 to \$10,776.61.



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## GEOGRAPHIC BOARD.

The Geographic Board, of which the secretary is an officer of the Department of the Interior, has published a bulletin with an illustrative map on the "Nomenclature of the Mountains of Western Canada" and a "Catalogue of the Maps in the Collection of the Geographic Board." So great has been the demand for this catalogue that a second edition, which will comprise almost all the modern maps of Canada, and many of the older ones, is in preparation.

The Board has revised its rules of nomenclature and these with its decisions on geographic questions since March 31, 1917, will be published in a report that is now in the press. This is also expected to contain a list of Micmac place names in the Maritime Provinces.

A report on Map Publication in the Departments of the Dominion Government was prepared by the Board at the request of the Joint Committee on Printing of Parliament.

## BOARD OF EXAMINERS FOR DOMINION LAND SURVEYORS.

The Board of Examiners for Dominion Land Surveyors held two meetings.

The first was a special meeting lasting from April 29, 1918 to May 31, 1918, inclusive, during which examinations were held at Ottawa, Vancouver, Calgary, and Winnipeg.

The second was the regular annual meeting called for by section 9 of the Dominion Lands Survey act. It began on Monday, February 10, 1919 and lasted until March 13, 1919. During this meeting examinations were held at Ottawa, Winnipeg, Edmonton, and Vancouver. The total number of candidates for examination was thirty. Of these seventeen tried the full preliminary examination, one tried the limited preliminary examination, nine tried the final, and three the examination for Dominion Topographical Surveyors.

Three candidates were successful at the preliminary examinations as follows:

De Stein, Joseph Nicholas, Calgary, Alberta.

Fry, Eric S., Vancouver, B.C.

Younger, Harry Robert, Ottawa, Ont.

Three candidates were successful at the final examination as follows:—

Burchnall, Ralph Parker, Calgary, Alberta.

Markham, Edwin, Winnipeg, Manitoba.

Bayly, Gilbert St. John, Edmonton, Alberta.

One candidate was successful at the examination for Dominion Topographical Surveyors, namely:—

Bingham, Harold Carr, Calgary, Alberta.

The time of the Board during the meetings was largely taken up with the reading and valuation of the candidates' answer papers. Complete sets of question papers to be used at the following examination were also prepared. In addition to this the evidence submitted by candidates at the final examination in proof of their eligibility therefor had to be examined. This evidence consisted of certificates of Provincial Land surveyors and of affidavits of service under articles of apprenticeship.

Four commissions were issued to candidates who had passed the final examination and had furnished oaths of office and allegiance and bonds for the sum of one thousand dollars as required by section 25, of the Dominion Lands Survey's Act.

Four certificates of preliminary examination were issued to successful candidates who had complied with the requirements of the law.

One certificate of Dominion Topographical Surveyor was issued to a candidate who had successfully passed the examination and complied with the requirements of the law.



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Section 35 of the Dominion Lands Surveys Act provides that every Dominion Land Surveyor shall be in possession of a subsidiary standard of length. During the year eight new standards were issued to surveyors and two measures which had previously been supplied were tested by the Department.

#### SURVEYS LABORATORY.

Several improvements and additions to our existing apparatus have been made. The main development has been extending the capacity and usefulness of the aneroid testing section. The large number of aneroids now being used in the field has necessitated the installation of larger and more efficient apparatus to deal with the increased amount of testing work. The following is a brief summary of the activities of the Laboratory.

#### *Metrology.*

The base has been periodically verified and the usual comparisons made of the laboratory standard tapes. Pending the arrival of the 1<sup>m</sup> rule which was detained at the International Bureau, Paris, owing to war conditions, two invar tapes were taken to the Bureau of Standards, Washington, for standardization. These tapes were verified on the Surveys Laboratory base before and after the Washington determination and thus a check was obtained on the length of the laboratory 4<sup>m</sup> rule. In the coming year it is hoped to institute periodic comparisons between the 1<sup>m</sup> and 4<sup>m</sup> rules. In this connection it might be mentioned that an order has been placed with the Société Genevoise d'Instruments de Physique for two additional 1<sup>m</sup> rules, one of pure nickel and the other of a 42 per cent nickel-steel alloy.

#### *Transits, Levels, Etc.*

The usual amount of routine testing work has been dealt with in this section.

#### *Thermometers.*

The apparatus of this section is being considerably developed. A pressure coefficient apparatus has been procured and working drawings were prepared for a hypsometer for determining the steam points of thermometers. This apparatus, which has recently been received, is of the International Bureau type and similar to that in use at the large physical testing laboratories. It is hoped that it will soon be possible to procure a platinum resistance thermometer for use as a standard in place of the standardized thermometers at present used.

#### *Aneroids.*

As mentioned previously a large amount of work has been thrown on this section due to the increased number of aneroids being used in the field. The most important addition to the aneroid testing apparatus is a thermal chamber which is used to contain the receivers during the temperature tests. This chamber has thick insulating walls and contains coils for heating and cooling purposes and maintaining the temperature constant for any desired period. Circulating fans within the chamber thoroughly agitate the air and maintain a uniform temperature. The aneroids are read through well-fitted windows in the top and front of the chamber.

In the past it has been found that considerable difference occurs in the quality of the aneroids purchased. For this reason the laboratory has drawn up a set of specifications and all aneroids now purchased are supplied on the understanding that any which fail during test to attain the tolerances, set by the laboratory, will



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not be accepted. By this means a better average class of aneroids will be supplied to the surveyors. A bulletin entitled "The Testing of Aneroid Barometers at the Laboratory of the Dominion Lands Surveys" has been published. This gives a brief account of the characteristics of aneroids and also describes the tests as conducted at the Laboratory.

*Watches.*

The greater portion of the watch testing apparatus at the Surveys Laboratory has been transferred to a new gallery built in the testing room. Not only does this relieve, to a limited extent, the congestion in the room but it also allows the temperature chambers, the relays, and the chronograph to be grouped closely together, thereby greatly facilitating the daily comparisons with the standard clock.

There are many instances where the owner of a watch finds it at least inconvenient to be deprived of his timepiece for the two months covered by our regular class A test. Appreciating this fact, we have devoted part of the year in developing a short form of test which will be sufficiently accurate to give a fair idea of the qualities of a watch, where such refinements as are necessary in a class A watch are not required.

Twenty-five watches were submitted to the regular class A test and twenty-four to the short test. Six, that is 26 per cent, passed the regular test.

The results of the trials of the watches which passed are tabulated herewith.



RESULTS OF WATCH TESTS.  
(Bureau of Standards Method.)

Name.	Maximum values allowable.	Waltham Watch Co.					Means.
Number of watch.....		T.S. 268	18091055	18091072	18028539	18028518	18028529
Escapement, balance spring, etc.....		D.r., g.b., l.e., s.o.	D.r., g.b., l.e., s.o.	D.r., g.b., l.e., s.o.	D.r., g.b., l.e., s.o.	D.r., g.b., l.e., s.o.	D.r., g.b., l.e., s.o.
Mean deviation of daily rate.....	0s 75	0.69	0.32	0.36	0.53	0.27	0.44
Mean of daily rates for each pair of position tests.....		-0.39	+5.51	-0.57	+3.68	-7.21	-7.21
Deviation for change of position.....	3s 0	2.38	1.61	1.32	0.90	2.21	2.17
Maximum difference between mean rates of position tests.....	10s 0	9.66	4.85	5.10	3.58	7.42	8.06
Difference between mean rates of P.U. and D.U. positions.....	5s 0	0.75	4.85	0.39	0.43	4.49	1.18
Difference between mean rates of D.U. and D.D. positions.....	4s 0	3.70	0.34	0.12	1.31	2.53	1.32
Progressive change of rate for position tests.....	3s 0	+0.92	+0.28	+0.49	-0.28	-0.15	-0.93
Recovery of rate.....	6s 0	+0.07	-0.83	+1.87	-1.50	+0.17	-2.90
Change of r. per 1° C.— A.....		-0.09	+0.02	-0.31	+0.03	-0.37	-0.31
B.....							
4:4-32:2.....	0s 20	+0.09	0.14	-0.11	+0.19	-0.17	-0.17
Algebraic difference between A and B.....	0s 3	0.18	0.12	0.17	0.16	0.20	0.17
Isochronism error.....	3s 0	+0.7	0.0	+2.4	-1.4	+1.2	+2.1
Relative performance.....		32.2	54.3	50.6	46.2	44.4	35.3

D.r. = Double roller; g.b. = Going barrel.  
l.e. = Lever escapement; s.o. = Single overcoil.  
P.U. = Pendant up; D.U. = Dial up; D.D. = Dial down



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For the above six watches, the average variation of daily rate for the position and temperature tests was as follows:—

Position Tests.					Temperature Tests.		
P.U. 82 F. 0.16	P.R. 82 F. 0.38	P.L. 82 F. 0.42	D.U. 82 F. 0.51	D.D. 82 F. 0.48	D.U. 42 F. 0.44	D.U. 67 F. 0.33	D.U. 92 F. 0.46

The smallest mean division of daily rate was 0.27 as compared with 0.38 in 1917-18 and 0.23 in 1916-17.

The average errors for position were:

P.U.	P.R.	P.L.	D.U.	D.D.
2.11	2.72	2.02	1.07	1.23

The smallest mean deviation for change of position was 0.90 as compared with 1.20 in 1917-18, 0.66 in 1916-17, and 0.75 in 1915-16.

Comparing the average errors with those for the last three years we have the following:—

	1916	1917	1918	1919
Average mean deviation of daily rate.....	0.49	0.26	0.43	0.44
Average mean deviation for change of position.....	2.08	1.79	1.80	1.80
Average change of daily rate per degree centigrade .....	0.09	0.09	0.06	0.15

The average isochronism error for these watches was 1.3; for the average marks obtained, 43.8; the highest, 54.3.

Of the nineteen watches which failed, two or 10.5 per cent stopped before the test was completed; four or 21 per cent failed in temperature correction only; and two or 10.5 per cent in one of the position tests only; the remaining eleven or 58 per cent failed to pass more than one tolerance.

LEVELLING DIVISION (Calgary).

The work in the Calgary office is of a varied nature, the chief task each year being to examine, check, and record the results of the previous field season. Levels, however, are becoming so extensive and their component parts so interwoven that an important part of the whole work is assimilating new lines of levels into the whole system. Every new line which intersects previous lines immediately disturbs the previous order, for levels, even the most precise are never final. This disturbance may be so small that all that is required is to note it carefully in the records, or it may be so great that the revision of some former line is called for. In the latter event the practice has always been to revise at once throughout and not to be content with inserting a note that a certain correction must be applied.

About 8,000 miles of records were entirely revised from the field books during the year, frequently applying a new datum or a new adjustment throughout.



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The contouring of the sectional sheets has been continued, twelve sheets being contoured and returned for printing. The work done in the office includes the reduction of all elevations direct from the field books of the levellers and their entry on the sheets together with the compilation of information regarding elevations from every other source than this branch, the latter being proportionately small.

The general work of the office included the examination of nearly all the level books of fourteen parties who took levels in the field the previous year, and the co-ordination and recording of the results; the close supervision of the three levelling parties who were employed running control lines in the field; and much miscellaneous work in supplying surveyors of this branch and other organizations with elevations for their particular requirements.



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APPENDIX No. 1.

AREA OF SURVEYED LAND IN MANITOBA, SASKATCHEWAN, AND ALBERTA.

Period.	Acres.	Number of Farms of 160 Acres each.
Previous to June, 1873	4,792,292	29,952
1874	4,237,864	26,487
1875	665,000	4,156
1876	420,507	2,628
1877	231,691	1,448
1878	306,936	1,918
1879	1,130,482	7,066
1880	4,472,000	27,950
1881	8,147,000	50,919
1882	10,186,000	63,662
1883	27,234,000	170,212
1884	6,435,000	40,218
1885	391,680	2,448
1886	1,379,010	8,620
1887	643,710	4,023
1888	1,131,840	7,074
1889	516,968	3,231
1890	817,075	5,106
1891	76,560	476
1892	1,395,200	8,720
1893	2,928,640	18,304
1894	300,240	1,876
1895	406,240	2,539
1896	506,560	3,166
1897	428,640	2,679
1898	859,840	5,374
1899	1,022,720	6,392
1900 (first 6 months)	735,480	4,596
1900-1901	1,603,680	10,023
1901-1902	2,553,120	15,957
1902-1903	6,173,440	38,584
1903-1904	12,709,600	79,435
1904-1905	10,671,520	66,697
1905-1906	4,973,920	31,087
1906-1907 (9 months)	3,819,700	23,873
1907-1908	6,123,040	38,269
1908-1909	7,412,870	46,330
1909-1910	7,423,200	46,395
1910-1911	5,683,200	35,520
1911-1912	5,146,080	32,163
1912-1913	5,155,520	32,222
1913-1914	5,193,280	32,458
1914-1915	4,484,960	28,031
1915-1916	3,112,640	19,454
1916-1917	2,221,280	13,883
1917-1918	1,323,360	8,271
1918-1919	91,520	572
	177,675,105	1,110,464



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## APPENDIX No. 2.

## SCHEDULE of surveyors employed and work executed by them:—

Akins, J. R., St. Catharines, Ont.—

Retracement of the 2nd base line across ranges 1 to 9, the 4th base across ranges 1 to 7 and the east outline of townships 5 to 7, range 7 all east of the Principal meridian; the Second meridian across townships 25 to 32; the 2nd base line across ranges 15 to 30, the east outlines of townships 1 to 4 range 28 and townships 9 to 12 range 29, the 3rd and 4th base lines across ranges 29 and 30 all west of the Fourth meridian; and the Fifth meridian across townships 5 to 8, 13 and 14.

Alexander, J. B., Calgary, Alta.—

Precise levels along the Canadian Pacific railway from Weyburn to Govenlock, 308 miles.

Bennett, G. A., Tillsonburg, Ont.—

Stadia surveys in tps. 37 to 40-25-3; tps. 37 to 41-26-3; tps. 24, 25, 26 and 37 to 42-27-3; tps. 24, 25, 26 and 38 to 42-28-3; tps. 24, 25, 26, 37 and 38-29-3; tps. 34 to 37, 39 and 40-1-4; tps. 34 to 37-2-4; tps. 34 to 38-3-4; tps. 34 to 36-4-4; tps. 34 to 37-5-4; tps. 34 to 37-6-4; tps. 34 to 37-7-4; tps. 33 to 35-8-4; tp. 34-9-4; tps. 34 and 35-13-4; tp. 34-14-4; tps. 32 and 33-16-4; tps. 32 to 34-17-4; tps. 33 and 34-18-4; tp. 34-19-4.

Blanchet, G. H., Ottawa, Ont.—

Retracement of the Fourth meridian from the 23rd base line to the 27th base line. Stadia traverse and exploration of lakes in the area between Churchill and Clearwater rivers.

Boulton, W. J., Wallaceburg, Ont.—

Stadia surveys in tp. 32-19-4; tps. 31, 32, and 33-20-4; tps. 29 to 32-21-4; tps. 29 to 32-22-4; tps. 29 to 32-23-4; tps. 29 to 32-24-4; tps. 29 to 32-25-4; tps. 29 to 32-26-4; tps. 28 to 32-27-4; tps. 21, 22, 28 to 32-28-4; tps. 20 to 23-29-4; tps. 19, 21, 22, 23 and 25 to 32-1-5; tps. 23 to 32-2-5; tps. 24 to 31-3-5; tps. 24 to 31-4-5; tps. 25 and 26-5-5; tp. 26-6-5.

Brenot, L., Ottawa, Ont.—

\*Classification of lands in the Peace River district between Smoky river and Lesser Slave lake, for the Soldier Settlement Board.

Bridgland, M.P., Calgary, Alta.—

Photo-topographical survey of the north part of the Bow forest in the Rocky Mountains forest reserve.

Buchanan, J.A., Edmonton, Alta.—

Partial subdivision of tps. 101 to 104-22-5; tps. 101 and 102-23-5; tps. 101 and 102-24-5. Survey of settlement at Carcajou point in tp. 101-19-5.

Cautley, R. W., Edmonton, Alta.—

Survey of interprovincial boundary between Alberta and British Columbia along the 120th meridian in the vicinity of Peace river.

Christie, W., Prince Albert, Sask.—

Stadia surveys of water areas in tps. 46, 47, 48 and 50-26-2; tps. 46 to 48-27-2; tps. 45 and 47-28-2. Examination of lands for Soldier Settlement Board in the Porcupine Forest reserve.

Cote, J. M., Ottawa, Ont.—

Retracement of school lands in tp. 35-3-3; tps. 35 to 38-4-3; tps. 35 to 38-5-3; tps. 35 to 38-6-3; tps. 36 to 38-7-3.

Cowper, G. C., Ottawa, Ont.—

Stadia surveys in tps. 1 and 2-21-3; tps. 1 to 6-22-3; tps. 1 to 8-23-3; tps. 1 to 8-24-3. tps. 1 to 8 and 10-25-3; tps. 1 to 10-26-3; tps. 1 to 10-27-3; tps. 1 to 10-28-3; tps. 1 to 10-29-3; tps. 1 to 10-30-3; tps. 11 and 18 to 22-1-4; tps. 11, 12, 15 and 18 to 21-2-4; tps. 11, 12 and 15 to 18-3-4; tps. 11 to 17-4-4; tps. 11 to 16, 20 and 21-5-4; tps. 11 to 17 and 19 to 21-6-4; tps. 11 to 17 and 19-7-4; tps. 12, 13, 14, 16, 17 and 19-8-4; tps. 13, 14, 15, 17, 18 and 19-9-4; tps. 2 to 17 and 20-10-4; tps. 11 and 12-11-4.

Davies, T. A., Edmonton, Alta.—

Stadia surveys in tps. 45-15 to 22-3; tps. 45 and 46-23-3; tps. 45 to 49-24-3; tps. 45 to 49, and 51 to 53-25-3; tps. 45 to 53-26-3; tps. 45 to 53-27-3; tps. 45 to 53-28-3; tps. 48 to 51-1-4; tps. 48 to 51-2-4; tps. 48 to 51-3-4.

Dozois, L. O. R., Calgary, Alta.—

Secondary levels along the 11th base line from the Fourth meridian to the Fifth meridian, 167 miles.

Fawcett, S. D., Ottawa, Ont.—

Classification of land in the Peace River district from Smoky river westerly to Pouce Coupe, for the Soldier Settlement Board.

Fontaine, L. E. Lévis, Que.—

Retracement of school lands in tp. 16-15-2; tps. 18 and 19-16-2; tps. 18 and 19-17-2; tps. 17, 18 and 19-18-2; tps. 18 and 19-19-2.

Glover, A. E., Edmonton, Alta.—

Retracement survey in tps. 44 and 45-14-3; tp. 38-19-3; tp. 38-20-3; tp. 49-22-3; tp. 44-28-3; tps. 45, 51, 52 and 53-1-4; tp. 34-10-4; tp. 67-12-4; tp. 40-14-4; tps. 56 and 57-15-4;



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- tp. 45-1-6. Correction survey in tp. 53-21-3; tp. 34-22-3; tp. 37-22-3; tp. 37-23-3; tp. 53-1-4; tp. 75-9-4; tp. 43-2-5. Resurvey in tp. 88-7-4; tp. 59-14-4. Stadia traverse in tp. 54-13-3; tp. 33-19-3; tp. 63-2-4; tp. 58-10-4; tp. 41-7-5. Inspection of dried up lakes in tp. 59-3-5; tp. 59-12-5. Survey of cemetery in tp. 49-27-5 at Pocahontas and at Jasper in tp. 45-1-6.
- Jackson, J. E., Hamilton, Ont.—**  
Subdivision of tp. 32-6-E, and part of 33-6-E. Resurvey of tp. 1-13-E. and tp. 21-2-Pr. Lot survey in tp. 39-3-E; tps. 32 and 39-4-E; tp. 32-5-E.
- Johnston, W. J., Vancouver, B.C.—**  
Subdivision in tp. 20-23-6; tps. 19 and 20-25-6; tp. 23-24-6; tp. 23-25-6; tps. 11 and 19-26-6; tp. 18-28-6; tps. 3 and 4-29-6. Retracement in tps. 19 and 20-25-6; tp. 18-28-6; tp. 4-29-6. Traverse in tp. 20-23-6.
- King, J. A. S., Ottawa, Ont.—**  
Retracement of school lands in tps. 9 to 12 and 14 to 16-22-Pr.; tps. 9, 11, 13, 15 and 16-23-Pr.; tps. 9 to 12 and 15-24-Pr.; tps. 9 and 10-25-Pr.; tps. 9 and 10-26-Pr.; tps. 9, 10 and 11-27-Pr.
- Knight, R. H., Edmonton, Alta.—**  
Resurvey of tp. 23-13-3; tp. 23-14-3; tps. 20 and 21-29-3; tp. 22-11-4. Retracement in tps. 19 and 20-4-3; tp. 33-5-3; tps. 35 and 36-8-3; tp. 17-10-3.
- LeBlanc, P. M. H., Ottawa, Ont.—**  
Stadia surveys in tps. 20 to 23-5-2; tps. 20 to 24-6-2; tps. 19a and 19 to 24-7-2; tps. 19a and 19 to 23-8-2; tps. 19a and 19 to 21-9-2; tps. 19a and 18 to 21-10-2; tps. 19a and 18 to 21-11-2; tps. 19a and 19 to 24-12-2; tps. 19 to 21-13-2; tps. 19, 21 and 32 to 34-14-2; tps. 21 and 32 to 35-15-2; tps. 32 to 35-16-2; tps. 26, 32, 34 and 35-17-2; tps. 32 to 35-18-2; tps. 32 and 33-19-2.
- Lonergan, G. J., Buckingham, Que.—**  
Inspection of survey parties under Dominion Land Surveyors, W. Christie, J. M. Cote, G. C. Cowper, S. D. Fawcett, A. E. Glover, P. M. H. LeBlanc, E. S. Martindale, P. J. McGarry, R. B. McKay, W. H. Norrish, C. Rinfret, H. M. R. Soars, N. C. Stewart.
- Martindale, E. S., Aylmer, Ont.—**  
Resurvey in tp. 10-3-2; tp. 26-24-2. Retracement in tp. 25-31-Pr.; tp. 18-33-Pr.; tp. 29-23-2; tps. 8 and 9-17-3; tp. 11-20-3; tp. 21-23-3; tp. 23-27-3. Correction survey in tp. 24-30-Pr.; tp. 5-17-2; tp. 28-23-2; tp. 18-14-3; tp. 18-20-3; tp. 24-23-3; tp. 26-9-4; tp. 26-12-4; tp. 11-27-4; tp. 11-28-4; tp. 30-2-5. Traverse in tp. 26-2-2; tp. 16-5-2; tps. 19 and 20-8-5. Topographical Survey of Waterton Park townsite.
- Montgomery, R. H., Prince Albert, Sask.—**  
Secondary levels along the east boundary of range 13 west of the Second meridian from the international boundary to the 11th base line, 240 miles.
- McEwen, D. F., Edmonton, Alta.—**  
Retracement of school lands in tps. 54 to 56-15-4; tps. 54 to 56-16-4 tps. 52 to 56-17-4; tps. 53 to 56-18-4; tp. 54-24-4.
- McGarry, P. J., Merritton, Ont.—**  
Stadia surveys in tps. 38, 39 and 42 to 46-6-3; tps. 38 to 40, 42, 43 and 45-7-3; tps. 38 to 46-8-3; tps. 38 to 45-9-3; tps. 38 to 44-10-3; tps. 39 to 43-11-3; tps. 39 to 43-12-3; tps. 40 to 42-13-3; tps. 41 to 43-14-3.
- McKay, R. B., Vancouver, B.C.—**  
Correction survey in tps. 38 and 39-18-2; tp. 38-24-2; tp. 39-2-3; tps. 38 and 39-4-3. Retracement in tp. 40-24-2; tp. 45-2-3; tp. 34-5-3; tp. 35-13-3; and tp. 35-15-3. Stadia surveys in tp. 49-14-2; tp. 44-1-3. Investigation of school lands in tp. 41-25-2; and tp. 44-26-2.
- Narraway, A. M., Ottawa, Ont.—**  
Inspection of survey parties under Dominion Land Surveyors, W. J. Boulton, L. Brenot, J. A. Buchanan, L. E. Fontaine, J. E. Jackson, J. A. S. King, R. H. Knight, D. F. McEwen, J. W. Pierce, C. H. Taggart, J. Vicars, and C. M. Walker.
- Norrish, W. H., Ottawa, Ont.—**  
Stadia surveys in tps. 37 and 39-20-4; tps. 34 to 36, 39 and 40-21-4; tps. 39 to 41-22-4; tp. 39-23-4; tp. 38-25-4; tp. 39-26-4; tps. 38 and 39-27-4; tp. 37-28-4. Resurvey of school lands in tp. 37-21-4; tps. 33 and 34-22-4; tp. 38-23-4; tp. 38-24-4; tp. 38-26-4; tps. 33, 35, 36, 38 and 39-28-4.
- Pierce, J. W., Pembroke, Ont.—**  
Stadia surveys of water areas in tps. 21 and 22-1-E; tps. 17 to 22-1-Pr.; tps. 17 to 22-2-Pr.; tps. 17 to 22-3-Pr.; tps. 17 to 22-4-Pr.; tps. 18 to 22-5-Pr. Investigation for the Soldier Settlement Board in tps. 20 and 21-16-Pr.; tp. 22-17-Pr.; tps. 19, 20, 22 and 23-18-Pr.; tps. 18 to 20-19-Pr.; tps. 18 to 20-20-Pr.; tp. 23-23-Pr.; tp. 25-24-Pr.; tp. 25-25-Pr.; tps. 23 to 25-26-Pr.
- Purser, R. C., Ottawa, Ont.—**  
Retracement survey in tp. 17-7-E; tp. 18-10-E; tp. 23-1-Pr.; tp. 4-7-Pr.; tp. 4-8-Pr.; tp. 56-26-Pr.; tp. 14-7-2. Correction survey in tp. 16-7-E; tps. 24 and 25-4-Pr.; tp. 25-5-Pr.; tp. 21-6-Pr.; Traverse in tp. 24-5-Pr.; tp. 23-8-Pr. Resurvey of school lands in tp. 11-6-2; tp. 14-8-2.



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## Rinfret, C., St. Stanislas, Que.—

Stadia surveys in tp. 6-3-2; tps. 7 and 8-5-2; tps. 7 and 8-6-2; tps. 7 and 8-7-2; tps. 7 and 8-8-2; tps. 7 and 8-9-2; tps. 7 to 10-10-2; tps. 9 and 10-12-2; tps. 7 to 10-13-2; tps. 7 to 10-14-2; tps. 7 to 10-15-2; tps. 7 to 10-16-2; tps. 7 to 10-17-2; tps. 4 and 7 to 10-18-2; tps. 1 and 2-19-2; tp. 1-20-2; tp. 1-21-2; tp. 1-22-2; tps. 1 and 10-23-2; tps. 1 to 49 and 10-24-2; tps. 1 to 3 and 9-25-2; tps. 1, 2, 9 and 10-26-2; tps. 1 to 4-27-2; tps. 1 to 4 and 12 to 15-28-2; tps. 1, 2, 5 and 12 to 16-29-2; tps. 1, 2, 12 and 14-29-2; tps. 15 and 16-30-2; tps. 12 to 16-1-3; tps. 13 and 14-2-3.

## Soars, H. M. R., Edmonton, Alta.—

Stadia surveys in tp. 55-10-4; tps. 52 to 55-11-4; tps. 52 to 54-12-4; tps. 52 to 55 and 57-13-4; tps. 52 to 54 and 56 to 58-14-4; tps. 52 and 53-15-4; tps. 52 to 54-16-4; tp. 49-23-4; tps. 45 to 53-24-4; tps. 46 to 50 and 52-25-4; tp. 46-26-4.

## Stewart, N.C., Vancouver, B.C.—

Subdivision in tps. 26 and 27-22-5; tps. 20, 21 and 28-1-6; tp. 27-2-6; tp. 23-6-6; tp. 22-7-6. Retracement in tp. 23-18-5; tp. 20-1-6. Traverse in tps. 26 and 27-22-5; tps. 20 and 21-1-6.

## Taggart, C. H., Kamloops, B.C.—

Retracement of school lands in tp. 13-1-E.; tp. 8-2-E.; tps. 7 to 13-3-E.; tps. 7 to 13-4-E.; tps. 7 to 13-5-E.; tps. 7 and 12-1-Pr.; tp. 12-2-Pr.; tp. 12-3-Pr.

## Vicars, John, Kamloops, B.C.—

Subdivision in tps. 20 and 21-13-6; tps. 16 and 17-16-6; tp. 18-17-6; tps. 17, 19 and 20-19-6; tps. 17, 20 and 23-20-6; tps. 22 and 23-21-6. Retracement in tps. 20 and 21-13-6; tps. 17 and 20-19-6. Traverse in tps. 16 and 17-16-6; tp. 20-19-6; tp. 17-20-6.

## Walker, C. M., Ottawa, Ont.—

Retracement of school lands in tps. 18 to 21-25-4; tps. 17 to 21-26-4; tps. 17 to 20-27-4; tps. 17 to 20-28-4; tps. 17 to 19 and 21-29-4; tps. 18, 21, 23 and 25 to 29-1-5; tps. 22, 25, 26, 28 and 29-2-5; tps. 24 to 29-3-5. Reposting lots in Banff cemetery.



SESSIONAL PAPER No. 25a

APPENDIX No. 3.

SCHEDULE showing for each surveyor employed the number of miles surveyed of section lines, township outlines, traverses of lakes and rivers, and resurvey; also the cost of the same. Surveyors whose work cannot be reckoned in miles are omitted from the statement.

	Miles of Section.	Miles of Outline.	Miles of Traverse.	Miles of Resurvey	Total Mileage.	Total Cost.	Cost per Mile.
						\$	\$ cts.
Akins, J. R.				354	354	14,342	40 51
Bennett, G. A.			772	16	788	8,347	10 59
Blanchet, G. H.			1,400	127	1,527	18,058	11 82
Boulton, W. J.			1,125		1,125	8,318	7 39
Buchanan, J. A.	235	45	19		299	13,778	46 08
*Christie, W.			481		481	9,043	18 80
Cote, J. M.				136	136	6,244	45 91
Cowper, G. C.			573	20	593	7,589	12 80
Davies, T. A.			626		626	7,185	11 48
Fontaine, L. E.				62	62	6,107	98 50
Jackson, J. E.	38		44	185	267	10,551	39 52
King, J. A. S.			5	216	221	5,901	26 70
Knight, R. H.				456	456	12,125	26 59
LeBlanc, P. M. H.			701	2	703	7,826	11 13
McEwen, D. F.				143	143	4,294	30 03
McGarry, P. J.			58		582	8,796	15 11
Norrish, W. H.			671	126	797	9,112	11 43
*Pierce, J. W.			413	89	502	10,111	20 14
Rinfret, C.			716	96	812	9,209	11 34
Soars, H. M. R.			390	117	507	6,629	13 07
Taggart, C. H.				151	151	5,006	33 15
Walker, C. M.				313	313	5,936	18 96
	273	45	8,518	2,609	11,445	194,507	16 99

\* Spent part of season examining lands for Soldier Settlement Board. Total cost includes depreciation of outfit.

APPENDIX No. 4.

DETAILS OF OFFICE WORK.

Sketches, maps, and tracings made	5,197
Descriptions of irregular parcels of land	11
Returns of survey examined—	
Township subdivision	18
Township outline	52
Stadia plots	831
Townships investigated for water areas	600
Road plans	479
Railway plans	48
Mineral claims	64
Correction and other miscellaneous surveys	199
Preliminary township plans	59
Township and miscellaneous plans compiled	789
"                    issued	759
Sectional maps issued (three miles to one inch—	
Revised maps	24
Photographic work—	
Dry plates and films	1,039
Prints	10,945
Prints mounted	3,685
Wet plate negatives	2,068
Photo litho plates	527
Lantern slides	60



APPENDIX No. 5.  
SURVEYING INSTRUMENTS ON HAND MARCH 31, 1919

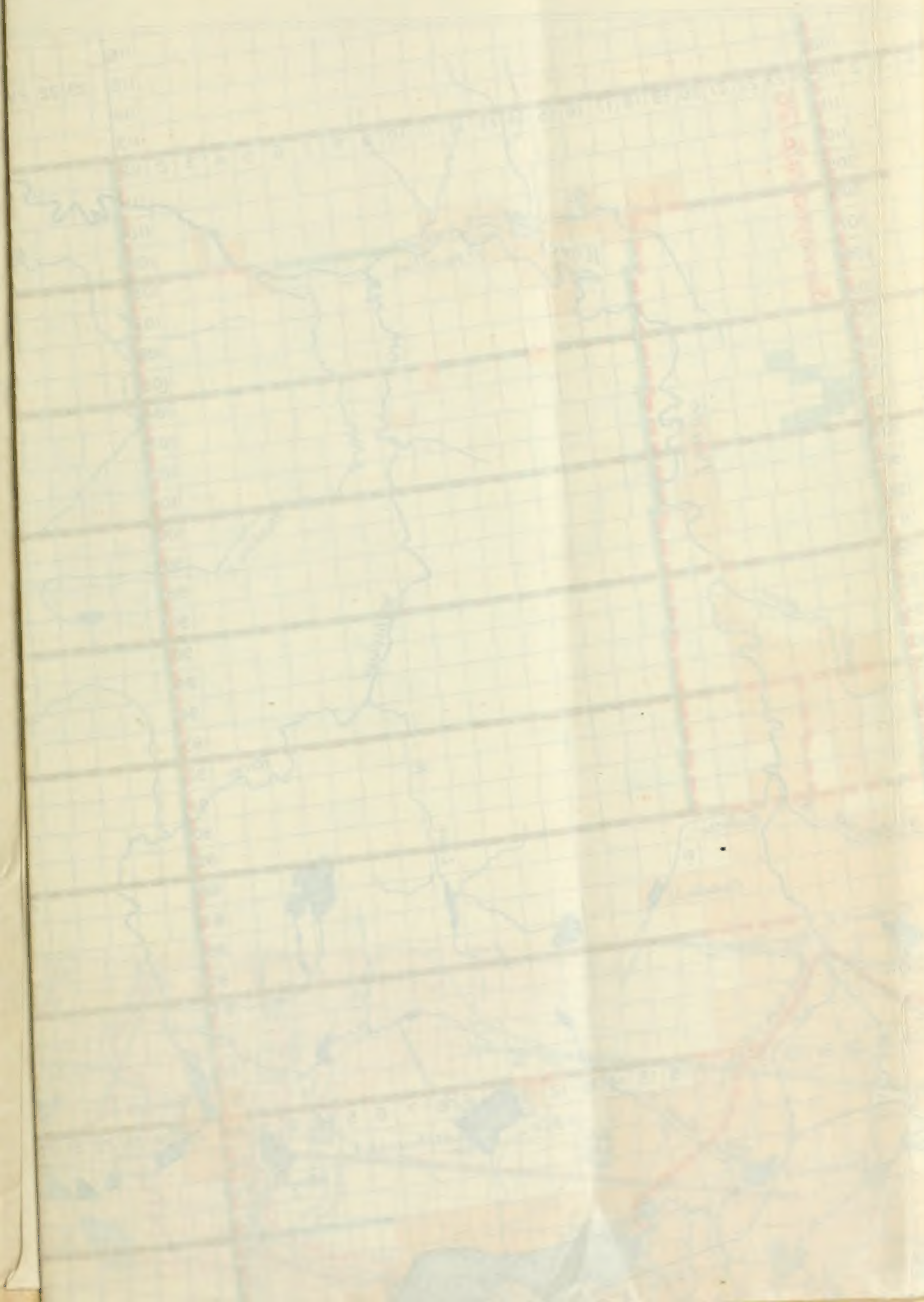
Instruments.	In stock April 1, 1918.	Purchased.	Balance.			Remarks.
			Sold.	Loan.	Store.	
Abney levels.....	27	2	11	1	18 1	received from Yukon office.
Alidades.....	1	.....	.....	.....	1	
Altazimuths.....	1	.....	.....	.....	1	
Aneroids.....	91	.....	.....	3	88	
Artificial horizons.....	4	.....	.....	.....	4	
Base line apparatus.....	1	.....	.....	.....	1	

Instruments.	In stock April 1, 1918.	Purchased	Balance.			Remarks.
			Sold.	Loan.	Store.	
Cameras and kodaks.....	18	.....	.....	6	12	
Chronometers and sidereal watches.....	55	2	4	.....	53	
Compasses.....	34	8	1	.....	38	3 lost on survey.
Current meters and logs.....	3	.....	.....	.....	3	
Dip circles.....	2	.....	.....	.....	2	
Field glasses and binoculars.....	6	.....	.....	.....	6	
Levels.....	52	.....	.....	5	46	1 worn out on survey.
Levelling rods.....	103	.....	.....	13	90	
Micrometer telescopes.....	8	.....	.....	.....	8	
Optical squares.....	1	.....	.....	.....	1	
Pedometers.....	2	15	.....	.....	16	1 lost on survey.
Photo-theodolites.....	5	.....	.....	.....	5	
Plane tables.....	1	.....	.....	.....	1	
Protractors.....	72	.....	.....	14	57	1 lost on survey.
Rod levels.....	20	12	.....	3	28	"
Sextants and reflecting circles.....	3	.....	.....	.....	3	
Solar compasses.....	2	.....	.....	.....	2	
Stadia rods.....	27	3	4	26	.....	
Stadia slide rules.....	60	.....	.....	8	52	
Steel tapes.....	160	14	14	6	154	
Subsidiary standard measures..	71	.....	3	.....	68	
Survey pickets.....	2	.....	.....	.....	2	
Surveying cameras.....	4	.....	.....	.....	4	
Tally registers.....	12	6	.....	.....	17	1 lost on survey.
Tape stretching apparatus.....	1	.....	.....	.....	1	
Telemeters.....	1	.....	.....	1	.....	
Thermometers.....	16	30	2	3	40	1 used for precise levelling rod.
Transit theodolites.....	62	10	5	3	63	1 worn out on survey.
Zenith telescopes.....	1	.....	.....	.....	1	



# INDEX TO TOWNSHIP

1918-1919





# INDEX TO TOWNSHIPS IN MANITOBA, SASKATCHEWAN, ALBERTA, AND BRITISH COLUMBIA

To Illustrate Progress of Dominion Lands Surveys

Scale, 35 miles to an inch



Subdivision surveys made prior to March 31, 1918.  
 Subdivision surveys made from April 1, 1918 to March 31, 1919.  
 Resurveys made from April 1, 1918 to March 31, 1919.

CAUTION:—This is only an index, topographical and other features are not to be depended upon.

Surveys in the Railway Belt in British Columbia are not shown owing to their scattered nature.  
 Lines of spirit levels run prior to March 31, 1919.  
 Base and meridian lines in subdivided lands run prior to March 31, 1919.  
 Townships wholly or partly leveled are not shown.



DEPARTMENT OF MINES

FOR THE CALENDAR YEAR

1919

1919

1919

1919



